OF 2003-2

Open File

New Nouveau
Brunswick

Natural Resources and Energy
Minerals, Policy and Planning

GEOCHEMISTRY, LITHOLOGY, AND DEPOSITIONAL HISTORY OF THE ROLLINGDAM (NTS 21 G/06) MAP AREA TILL, SOUTHWESTERN NEW BRUNSWICK

Serge Allard

ISSN 1702-2649
ISBN 1-55236-973-0
Price: $11.00

2003

Open File 2003-2

Geochemistry, lithology, and depositional history of the Rollingdam (NTS 21 G/06) map area till, southwestern New Brunswick.

Recommended citation:

ALLARD, S. 2003. Geochemistry, lithology, and depositional history of the Rollingdam (NTS 21 G/06) map area till, southwestern New Brunswick. New Brunswick Department of Natural Resources and Energy; Minerals, Policy and Planning Division, Open File 2003-2, 218 p.

Reprinted by:

Minerals, Policy and Planning Division
Department of Natural Resources and Energy
Province of New Brunswick

Hon. Jeannot Volpé
Minister of Natural Resources and Energy

February, 2003

New Nouveau
Brunswick

Natural Resources and Energy
Minerals, Policy and Planning

Open File 2003-2

Geochemistry, lithology, and depositional history of the Rollingdam (NTS 21 G/06) map area till, southwestern New Brunswick

Serge Allard

ISSN 1702-2649
ISBN 1-55236-973-0
Price: $11.00

2003

ABSTRACT

A total of 272 till samples were collected in the Rollingdam area of southwestern New Brunswick (NTS 21 G/06) and analyzed for patterns of glacial dispersal. The concentrations of 49 chemical elements and various clast lithologies as well as till fabric analysis were used to delineate the dominant glacial transport trajectories in an area of complex ice-flow history.

The results of this study demonstrate that two depositional ice-flow events affected the study area during the Wisconsinan episode of glaciation. Chronologically, the early event flowed towards the southeast (~ 130° to 150°), while the later, much weaker event, followed a south-southwest trajectory (~210° to 220°). Both trends are apparent in the striae record and in the case of the southeasterly trend, dispersal is parallel to intensive megafluting and drumlinization. These trajectories correspond to ice-flow patterns described by previous workers who assign their ages respectively as Early Wisconsinan (> 53 ka B.P.) and Late Wisconsinan (~15-13.5 ka B.P.).

A single basal till unit of local derivation with texture and colour reflecting local bedrock units was encountered in the study area. The deposition of this till resulted from initial southeastward flowing ice and was later reworked (imprinted) by south-southwestward flowing ice. In this sequence the younger event did not produce a recognizable deposit but, instead, it altered the pre-existing till through a moderate redistribution of the matrix components and realignment of the fabric. The result is a 'hybrid till', hence indicating that the two depositional trajectories delineated in this study, represent a shift in outflow orientation within a common ice sheet rather than multiple glacial advances.

Dispersal trains in the geochemical medium tend to form short high-contrast 'bulls-eye'- or 'amoeboid'-shaped anomalies that are lost within approximately 10 km of the presumed source. Clast trains tend to be longer, up to 36 km, and better accentuate the dominant southeasterly transport path. Although some matrix geochemistry dispersal trains show palimpsest dispersal sets reflecting the hybrid nature of the till and the multidirectional transport history, some elements show dispersal patterns complicated by epigenetic redistribution. These results imply that for simple drift prospecting exercises in areas of complex glacial history, dominant transport path and source unit are more clearly delineated by shape and size of till clast dispersal patterns than by analysis of matrix geochemistry. However, to fully understand the depositional history of a till sheet a comprehensive but cautious examination of the till geochemistry is required.

RÉSUMÉ

Deux cents soixante-douze échantillons de till ont été prélevés dans le secteur de Rollingdam dans le Sud-Ouest du Nouveau-Brunswick (SNRC 21 G/06) et ont été soumis à des analyses visant à définir les tracés de dispersion glaciaire. On s'est appuyé sur les concentrations de 49 éléments chimiques, sur diverses études pétrographiques des clastes ainsi que sur des analyses de la fabrique du till pour délimiter les trajets de transport glaciaire prédominants dans un secteur au passé complexe en fait d'écoulements glaciaires.

Les résultats de cette étude révèlent que deux écoulements glaciaires de sédimentation ont affecté le secteur d'étude pendant l'épisode de glaciation du Wisconsin. Du point de vue chronologique, le premier écoulement survenu s'est dirigé vers le sud-est (~ 130° à 150°), tandis que l'écoulement ultérieur, beaucoup plus faible, a suivi une trajectoire sud-sud-ouest (~210° à 220°). Les deux tracés sont visibles dans le registre des stries; dans le cas du tracé en direction du sud-est, la dispersion est parallèle à un rainurage et une drumlinisation intensifs. Ces trajectoires correspondent aux modes d'écoulement des glaces décrits par des chercheurs précédents, qui ont situé leurs âges, respectivement, au Wisconsinien précoce (>53 millions d'années avant nos jours) et au Wisconsinien tardif (~15 à 13,5 millions d'années avant nos jours).

On a rencontré dans le secteur d'étude une section de till de fond unique d'origine locale dont la texture et la couleur correspondent à des sections du substrat rocheux local. Le dépôt de ce till est survenu par suite de l'écoulement glaciaire initial vers le sud-est; le till a été ultérieurement remanié (marqué) par l'écoulement glaciaire en direction sud-sud-ouest. Au cours de cette séquence, l'écoulement le plus récent n'a pas produit un dépôt reconnaissable, mais il a plutôt altéré le till préexistant en effectuant une redistribution modérée des éléments de la gangue et en remaniant la fabrique. Il en a résulté un « till hybride », qui révèle que les deux trajectoires de sédimentation délimitées dans le cadre de cette étude représentent un changement d'orientation de l'écoulement à l'intérieur d'une nappe glaciaire commune plutôt que plusieurs progressions glaciaires.

Les tracés de dispersion dans le milieu géochimique forment généralement de brèves anomalies en forme d'œil de bœuf ou d'amiboïde à fort contraste qui s'évanouissent à moins d'une dizaine de kilomètres de la source présumée. Les tracés de clastes, qui atteignent jusqu'à 36 kilomètres, sont généralement plus longs et ils accentuent mieux le parcours du transport prédominant vers le sud-est. Même si certains tracés de dispersion géochimiques de la gangue affichent des ensembles de dispersion palimpsestes témoignant de la nature hybride du till et d'un transport dans plusieurs directions au cours du passé, certains éléments présentent des modes de dispersion compliqués par une redistribution épigénétique. Ces résultats laissent supposer que dans le cas des exercices de prospection glacio-sédimentaires simples dans les secteurs au passé glaciaire complexe, le parcours de déplacement prédominant et l'unité d'origine sont plus clairement délimités par la forme et par la taille des tracés de dispersion des clastes du till que par une analyse de la géochimie de la gangue. Il faut toutefois réaliser un examen détaillé mais prudent de la géochimie du till pour comprendre tout à fait le passé sédimentaire d'une nappe de till.

TABLE OF CONTENTS

ABSTRACT i
TABLE OF CONTENTS iii
LIST OF FIGURES v
LIST OF TABLES viii
LIST OF PHOTOGRAPHIC PLATES ix
ACKNOWLEDGEMENTS x

CHAPTER 1 INTRODUCTION 1
- 1.1 Purpose and Scope 2
- 1.2 Location and Access 3
- 1.3 Physiography and Drainage 7
- 1.4 Bedrock Geology 10
    - 1.4.1 Mineral Occurrences 13

CHAPTER 2 PREVIOUS WORK 16
- 2.2 Glacial Studies in southwestern New Brunswick 16
- 2.1 Glacial Studies in the Rollingdam area 17

CHAPTER 3 METHODOLOGY 19
- 3.1 Field Methods 19
- 3.2 Laboratory Methods 22
- 3.3 Statistical Methods 26

CHAPTER 4 CURRENT GLACIAL THEORIES 28
- 4.1 Glaciation of southwestern New Brunswick 29
    - 4.1.1 Pre- Late Wisconsinan Glaciation 29
    - 4.1.2 Late Wisconsinan Glaciation 30
- 4.2 Deglaciation of southwestern New Brunswick 36
- 4.3 Summary 37

CHAPTER 5 RESULTS AND INTERPRETATIONS 38
- 5.1 Till Characteristics 38
    - 5.1.1 Basal Till 39
    - 5.1.2 Ablation Till 41
- 5.2 Granulometric Analysis 43
    - 5.2.1 Sand 45
    - 5.2.2 Silt 47
    - 5.2.3 Clay 47
- 5.3 Lithological Analysis 53
    - 5.3.1 Clastic Sedimentary Lithologies 54
    - 5.3.2 Intrusive Lithologies 59

5.3.3 Extrusive Lithologies 62
5.4 Geochemical Analyses 66
5.4.1 Lithophile Elements 69
5.4.2 Chalcophile Elements 72
5.4.3 Siderphile Elements 74
5.4.4 Rare Earth Elements 78
5.4.5 Regional Scale Geochemical Trends 83
5.5 Statistical Correlations 83
5.6 Erosional Indicators 84
5.7 Till Fabric Analysis 88

CHAPTER 6 DISCUSSION 95
6.1 Depositional Ice-Flow Paths 95
6.1.1 Southeastward Dispersal 95
6.1.2 South-southwestward Dispersal 96
6.1.3 Chronology of Events 97
6.2 Regional Ice-Flow Models 98

CHAPTER 7 CONCLUSIONS 101

REFERENCES 104
APPENDIX 1: Sample Site Locations 109
APPENDIX 2: Granulometric Analysis Data 116
APPENDIX 3: Summary of Lithological Analysis 124
APPENDIX 4: Geochemical Analysis Data 131
Part A: Geochemical Results from ICP-MS Analysis 131
Part B: Geochemical Results from INAA Analysis 158
Part C: Precision and Accuracy of the Geochemical Data 178
APPENDIX 5: Statistics and Histograms for Till Geochemistry 193

LIST OF FIGURES

Figure 1.1 Location of study area and generalized bedrock geology of New Brunswick. 4

Figure 1.2a Base map: western half of the Rollingdam study area. 5

Figure 1.2b Base map: eastern half of the Rollingdam study area. 6

Figure 1.3 Physiography of southwestern New Brunswick with study area highlighted. 9

Figure 1.4 Tectonostratigraphic zones of New Brunswick. 11

Figure 1.5 Generalized bedrock geology of the study area. 12

Figure 1.6 Documented mineral occurrences in the study area. 14

Figure 3.1 Sample site locations in the Rollingdam study area. 20

Figure 4.1 Ice-flow directions during the Chignecto phase. 32

Figure 4.2 Ice-flow directions during maximum extent of the Bantalor phase. 33

Figure 4.3 Ice-flow directions during maximum extent of the Millville/Dugavon phase. 35

Figure 5.1 Percent sand in till (classed post). 46

Figure 5.2 Percent sand in the till matrix (contour plot). 48

Figure 5.3 Percent silt in till (classed post). 49

Figure 5.4 Percent silt in the till matrix (contour plot). 50

Figure 5.5 Percent clay in till (classed post). 51

Figure 5.6 Percent clay in the till matrix (contour plot). 52

Figure 5.7 Maroon sandstone clast dispersal in till. 55

Figure 5.8 Maroon siltstone clast dispersal in till. 56

Figure 5.9 Maroon conglomerate clast dispersal in till. 57

Figure 5.10 Combined maroon sedimentary clast dispersal in till. 58
Figure 5.11 Combined intrusive clast dispersal in till. 60
Figure 5.12 Granitic clast dispersal in till. 61
Figure 5.13 Gabbroic clast dispersal in till. 64
Figure 5.14 Felsic volcanic clast dispersal in till. 65
Figure 5.15 Mafic volcanic clast dispersal in till. 67
Figure 5.16 Strontium dispersal in the till matrix (ICP-MS). 70
Figure 5.17 Chromium dispersal in the till matrix (ICP-MS). 71
Figure 5.18 Thallium dispersal in the till matrix (ICP-MS). 73
Figure 5.19 Gallium dispersal in the till matrix (ICP-MS). 75
Figure 5.20 Copper dispersal in the till matrix (ICP-MS). 76
Figure 5.21 Gold dispersal in the till matrix (INAA). 77
Figure 5.22 Molybdenum dispersal in the till matrix (ICP-MS). 79
Figure 5.23 Ytterbium dispersal in the till matrix (INAA). 80
Figure 5.24 Cesium dispersal in the till matrix (INAA). 81
Figure 5.25 Cerium dispersal in the till matrix (INAA). 82
Figure 5.26 Histogram showing frequency distribution of striae orientation throughout the study area. 87
Figure 5.27 Locations of till fabrics examined throughout the study area. 91
Figure 5.28 Rose diagrams of till fabrics examined in the study area. 94
Figure IV.a Arsenic dispersal in the till matrix (ICP-MS). 185
Figure IV.b Antimony dispersal in the till matrix (ICP-MS). 186
Figure IV.c Lead dispersal in the till matrix (ICP-MS). 187

Figure IV.d Zinc dispersal in the till matrix (ICP-MS). 188

Figure IV.e Cobalt dispersal in the till matrix (ICP-MS). 189

Figure IV.f Silver dispersal in the till matrix (ICP-MS). 190

Figure IV.g Mercury dispersal in the till matrix (ICP-MS). 191

Figure IV.h Bismuth dispersal in the till matrix (ICP-MS). 192

LIST OF TABLES

Table 3.1 Elements analyzed by ICP-MS and their corresponding detection limits. 24

Table 3.2 Elements analyzed by INAA presented in this report and their corresponding detection limits. 25

Table 5.1 Selected results from Spearman's Rank Correlation. 85

Table 5.2 Orientation and locations of striae throughout the study area. 86

Table 5.3a Results of till fabric #1 and till fabric #2. 92

Table 5.3b Results of till fabric #3 and till fabric #4. 93

Table IV-1 Elements analyzed and corresponding detection limits (ICP-MS). 131

Table IV-2 Elements analyzed and corresponding detection limits (INAA) 158

Table IV-3 Results from ICP-MS analyses of laboratory standards obtained from the Geological Survey of Canada. 179-181

Table IV-4 Results from ICP-MS analyses of laboratory standards obtained from the Geological Survey of Canada. 182-184

LIST OF PHOTOGRAPHIC PLATES

Plate 1.1 Oblique aerial photos showing the Upper Canoose Flowage and part of the Canoose Flowage. 8

Plate 2.1 Section of ice-contact sediment found just north of Fahey's Hill. 18

Plate 3.1 Typical soil profile of the study area. 21

Plate 5.1 Wedge of flow-till embedded in a profile of ice-contact sediment found near Fahey's Hill in the southwestern corner of the study area. 40

Plate 5.2 Granite boulders derived from the Pokiok Granite, which is located approximately 10 km north of the study area. 63

Plate 5.3 Striated bedrock (Shin Formation) found at Summer Hill in the northeastern corner of the study area. 90

ACKNOWLEDGEMENTS

Most importantly, I would like to express sincere appreciation to Dr. Bruce Broster, University of New Brunswick (UNB) and Toon Pronk, New Brunswick Department of Natural Resources (NBDNRE) for making this project possible and for providing invaluable guidance throughout its duration. Dr. Ron Pickerill (UNB) deserves recognition for thoroughly reviewing my thesis. I would also like to extend gratitude to Rex Boldon (NBDNRE) who aided with the considerable sample preparation involved with this project and for the camaraderie both in the field and in the lab. Field assistants Kristin Knorr, Michelle Doiron and Robert Richard also deserve acknowledgement. Thanks to Allen Seaman (NBDNRE) for providing insight into the glaciation of southwestern New Brunswick and to D. V. Venugopal (NBDNRE) for helping with clast identification and provenance. Finally, I would like to express how grateful I am to Amanda Cleghorn, for without her encouragement and personal sacrifice; I would not have had the focus and determination to see this project through to completion in such a timely manner.

CHAPTER 1

INTRODUCTION

Approximately ninety percent of New Brunswick is covered with unconsolidated materials either deposited directly by the action of glaciers or derived from the wasting of glaciers (Pronk and Ruitenberg, 1991). A comprehensive knowledge and understanding of these materials can be exceedingly beneficial for defining potential mineral exploration targets and delineating the glacial history of an area. Historically, glacial overburden has been considered as a hindrance to geochemical exploration but conversely, with the proper understanding of glacial deposits and glacial history it can be used as an effective exploration medium (Shilts, 1975).

Basal till, the most common glacial sediment used for drift prospecting, is the focus of this study, although samples of ablation till have been collected where basal till was not available. As outlined by Shilts (1975), there are convincing reasons for using basal till as the preferred medium in geochemical exploration. These reasons are (1) its widespread distribution; (2) the ease of delineating till stratigraphy and with relating a till unit to specific ice-flow directions; (3) the observation that unweathered basal till commonly represents ground-up bedrock deposited down-ice of the source; (4) the relative ease of recognizing basal till compared to other glacial sediments; and (5) the fact that dispersal trains in till often make for larger exploration targets than the actual source of the train.

Also, because dispersal trains are relatively huge targets when compared to their source, till geochemistry surveys have the potential for being cost-effective and efficient, allowing for relatively large sample spacing without the risk of missing an anomaly (Broster and Huntley, 1995). This supports the use of basal till as an ideal medium for regional scale geochemical surveys.

1.1 Purpose and Scope

Regional till sampling was conducted within the Rollingdam map area (NTS 21 G/06) during the summer of 2001 with some follow-up work conducted during June and July of 2002. The primary objective of the survey was to attempt to recognize patterns of glacial dispersal by studying component geochemical and lithological distribution within the area's cover till. The silt plus clay fraction of 272 till samples was analyzed for base metal, trace element and rare earth concentrations, while the pebble-sized clast fraction lithologies were examined by identification of hand specimen.

Statistical methods were used to characterize the areal distribution of 49 chemical elements and various clast lithologies for the purpose of identifying and comparing dispersal patterns within the till matrix and clast mediums. Orientation and shape of the emergent dispersal patterns were examined and then compared with ice-flow directional indicators mapped in the field to identify any predominant correlations. This investigation led to the delineation of the dominant depositional ice-flow paths that affected the study area. Also, various geochemical anomalies, some of which may indicate economic potential, have been delineated and are presented in this report.

A subsidiary objective of this project was to characterize basal till and ablation till found throughout the study area on the basis of grain size distribution, colour, and compactness. These are considered important factors for reconstructing the till stratigraphy of an area or when assessing the potential for elemental partitioning into various grain size parameters. The results of this survey are of primary significance to the mineral exploration industry but are also pertinent to forestry and agricultural endeavors, landfill siting, as well as land-use and environmental planning (Pronk and Ruitenberg, 1991; Parkhill, 1994).

1.2 Location and Access

The study area, located in southwestern New Brunswick, Canada, is represented by NTS map sheet 21 G/06 Rollingdam (Fig. 1.1, 1.2a, 1.2b). It is bound by the international Canada-U.S.A. border (St. Croix River) to the west, longitude 67°00' to the east, and by latitudes 45°15' and 45°30, totaling an area of approximately 1000 km^2 (Fig. 1.2a, 1.2b). The area is typical of small villages with low population. Lawrence Station, Moores Mills, and Rollingdam are some of the more notable communities in the area (Fig. 1.2a, 1.2b).

Arterial Highway 3 provides the main access route into the region as it runs south-southeast, approximately bisecting the map area. Collector Highway 127 as well as Local Highways 770, 630, 730, 745 provide essential access to various sectors of the map area while other local highways provide limited access (Fig. 1.2a, 1.2b).

The interior of the study area is reached by vehicle, via networks of both abandoned and new logging roads as well as private roads. Where there is no roadway, access can be facilitated by footpaths, cut-lines and rail lines.

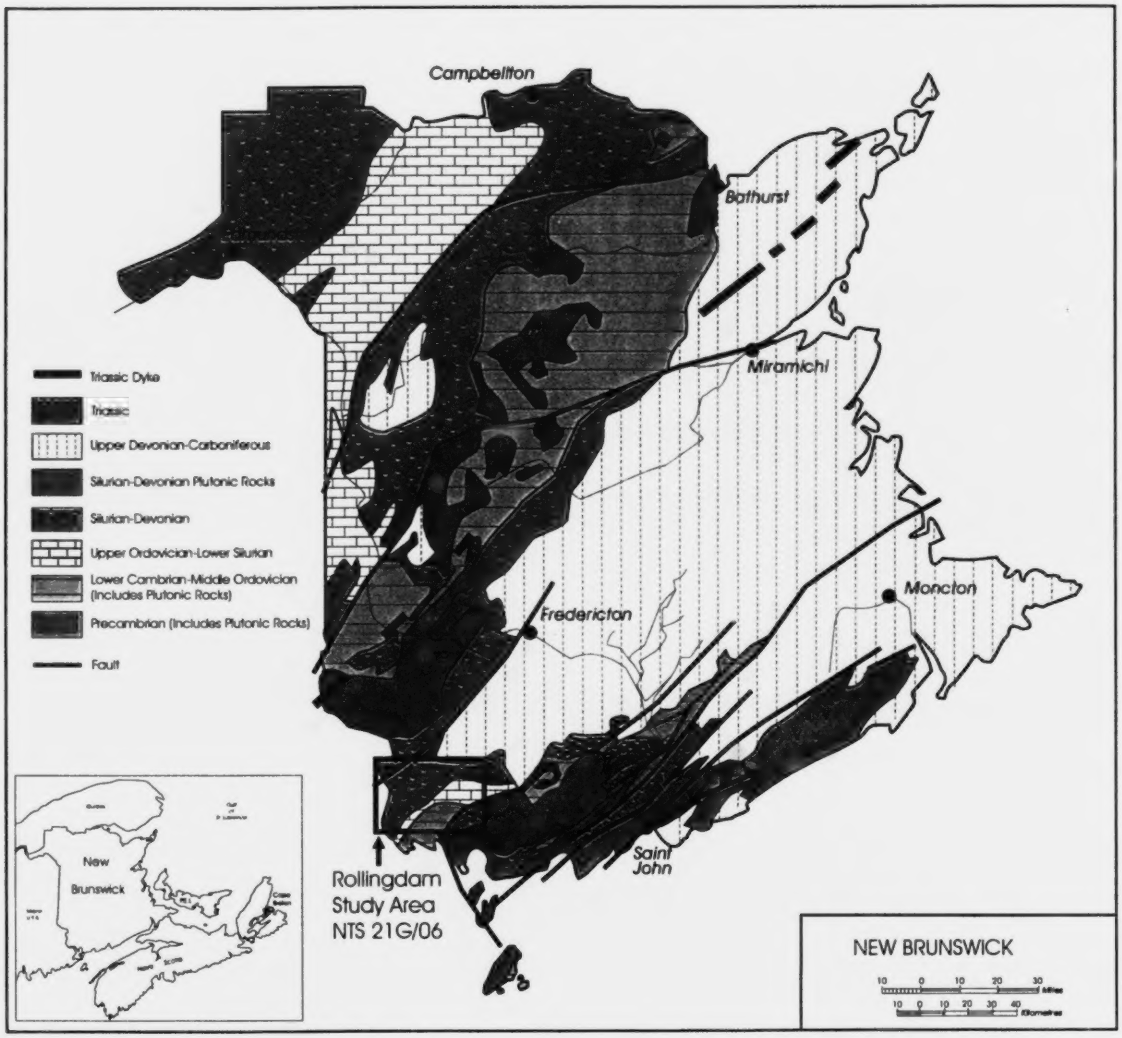
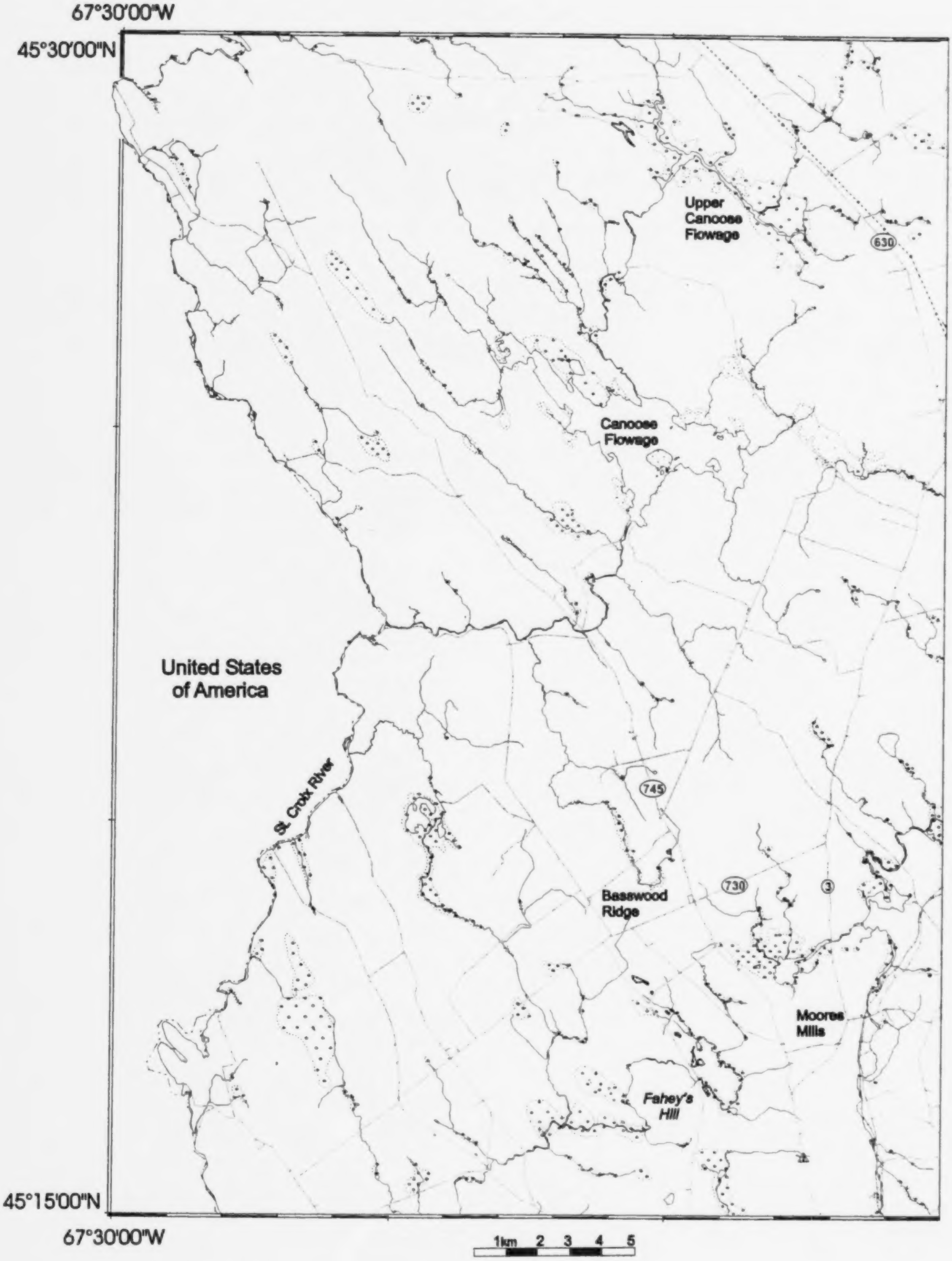

Campbellton
Bathurst
Miramichi
Fredericton
Moncton
Saint John
Rollingdam
Study Area
NTS 21G/06
Triassic Dyke
Triassic
Upper Devonian-Carboniferous
Silurian-Devonian Plutonic Rocks
Silurian-Devonian
Upper Ordovician-Lower Silurian
Lower Cambrian-Middle Ordovician (Includes Plutonic Rocks)
Precambrian (Includes Plutonic Rocks)
Fault
New
Brunswick
Cape Breton
Nova Scotia
NEW BRUNSWICK
10 0 10 20 30 Miles
10 0 10 20 30 40 Kilometres

Fig. 1.1 - Location of study area and generalized bedrock geology of New Brunswick.



67°30'00"W
45°30'00"N
Upper Canoose Flowage
630
Canoose Flowage
United States of America
St. Croix River
745
730
3
Basswood Ridge
Moores Mills
Fahey's Hill
45°15'00"N
67°30'00"W
1km 2 3 4 5

Fig. 1.2a - Base map: western half of the Rollingdam study area (NTS 21 G/06).

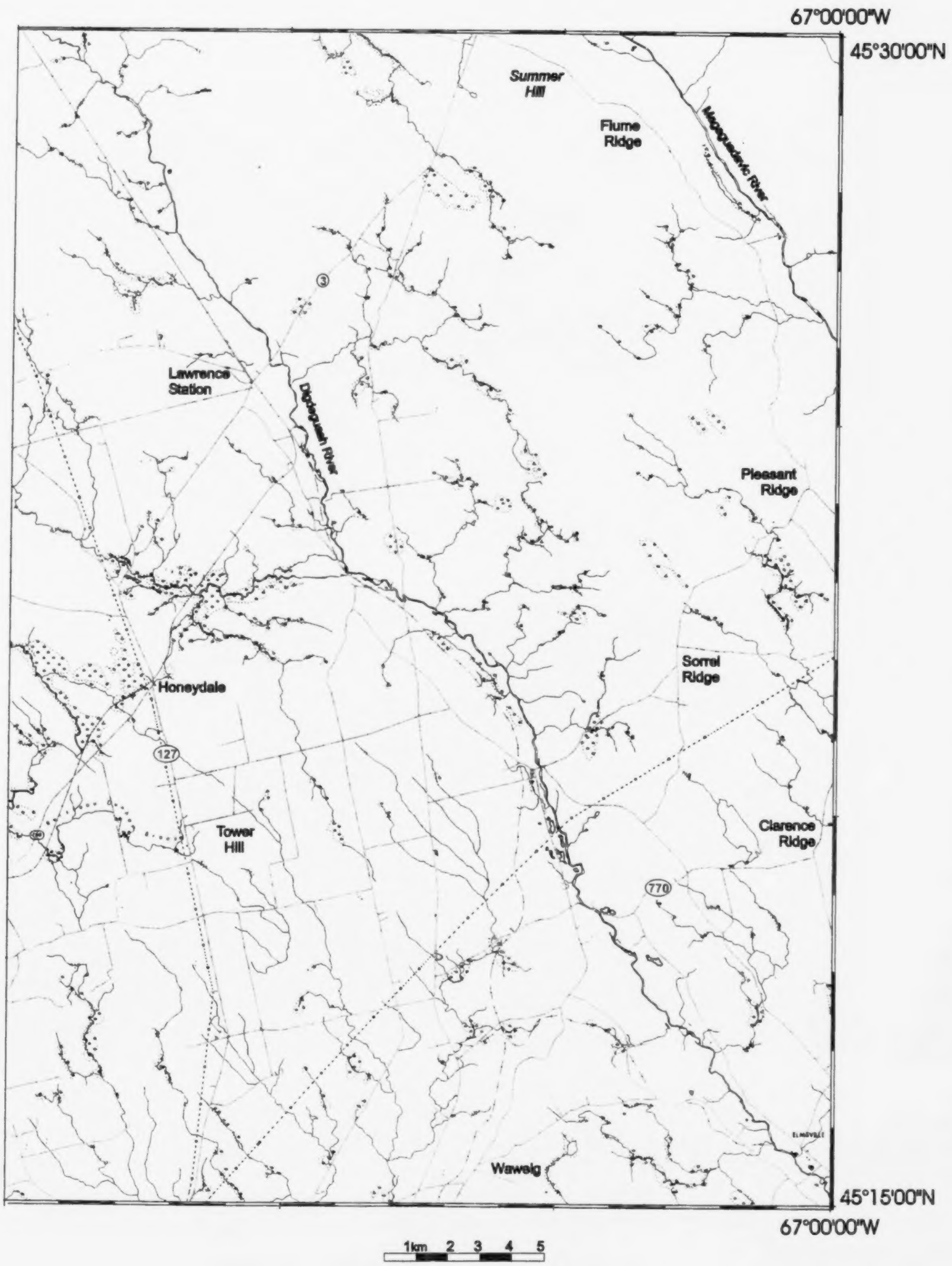

67°00'00"W
45°30'00"N
Summer Hill
Flume Ridge
Magaguadavic River
3
Lawrence Station
Digdeguash River
Pleasant Ridge
Sorrel Ridge
Honeydale
127
Tower Hill
Clarence Ridge
770
Waweig
45°15'00"N
67°00'00"W
1km 2 3 4 5

Fig. 1.2b - Base map: eastern half of the Rollingdam study area (NTS 21 G/06).

1.3 Physiography and Drainage

The study area lies entirely within the St. Croix Highlands physiographic subdivision of the New Brunswick Highlands (Bostock, 1970; Fig. 1.3) and is part of the northern extension of the Appalachian geosynclinal belt (Ruitenberg, 1967). Rampton et al. (1984) further subdivide the area into the Magaquadavic Highlands subdivision and the Bocabec Hills subdivision (Fig. 1.3). The relatively flat Magaquadavic Highlands comprise most of the study area while the granite-cored Bocabec Hills occupy the southeastern corner of the area (Fig. 1.3).

The Magaquadavic Highlands topography is characterized by flat terrain generally lying below 210 metres in elevation. The terrain surface is undulating due to the widespread occurrence of streamlined ridges aligned in a northwest-southeast direction. These ridges are probably the result of extensive glacial fluting. Wide valleys separate these ridges and in some instances give way to broad depressions, as found in the northeastern portion of the study area (e.g., Canoose Flowage; Fig. 1.2a, Plate 1.1). Local relief is typically of low magnitude and variable, on the order of ten to twenty metres, although up to 100-120 metres.

The southeastern portion of the study area, occupying part of the Bocabec Hills physiographic subdivision, is inherently different than the Magaguadavic Highland topography. This area consists of rugged rocky granite-cored hills with an average elevation of approximately 200 metres. However, Pleasant Ridge, the highest peak in the study area, has an elevation of 284 metres. Relief is more substantial in this area, generally ranging between 70 and 100 metres. Like the Magaguadavic Highlands terrain surface, numerous ridges and valleys are aligned in a northwest-southeast fashion resulting from intense drumlinization and fluting.

Plate 1.1 - Oblique aerial photos showing the Upper Canoose Flowage (top) and part of the Canoose Flowage (bottom). The bottom plate also shows the alligned rolling landscape characteristic of the study area.

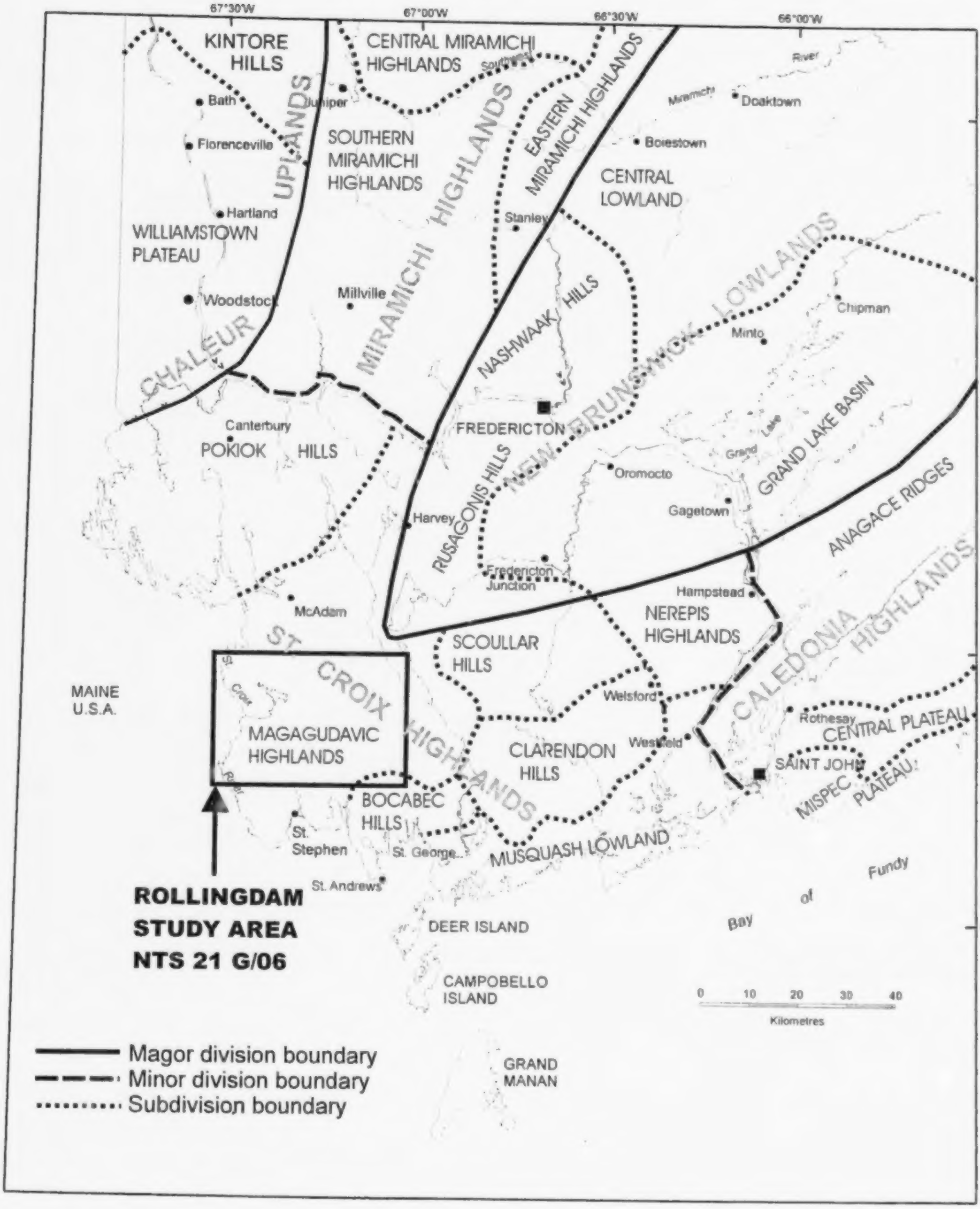

67°30'W
67°00'W
66°30'W
66°00'W
46°30'N
46°00'N
45°30'N
45°30'N
KINTORE HILLS
CENTRAL MIRAMICHI HIGHLANDS
UPLANDS
Bath
Juniper
Florenceville
SOUTHERN MIRAMICHI HIGHLANDS
MIRAMICHI HIGHLANDS
EASTERN MIRAMICHI HIGHLANDS
Miramichi
River
Doaktown
Boiestown
CENTRAL LOWLAND
Hartland
WILLIAMSTOWN PLATEAU
Stanley
Woodstock
Millville
NASHWAAK HILLS
NEW BRUNSWICK LOWLANDS
Chipman
Minto
CHALEUR
FREDERICTON
Canterbury
POKIOK HILLS
RUSAGONIS HILLS
Oromocto
Grand Lake
GRAND LAKE BASIN
Gagetown
Harvey
ANAGACE RIDGES
Fredericton Junction
Hampstead
McAdam
NEREPIS HIGHLANDS
CALEDONIA HIGHLANDS
ST. CROIX HIGHLANDS
SCOULLAR HILLS
MAINE U.S.A.
Welsford
MAGAGUDAVIC HIGHLANDS
Rothesay
CENTRAL PLATEAU
CLARENDON HILLS
Westfield
SAINT JOHN
MISPEC PLATEAU
BOCABEC HILLS
St. Stephen
St. George
MUSQUASH LOWLAND
ROLLINGDAM STUDY AREA NTS 21 G/06
St. Andrews
Bay of Fundy
DEER ISLAND
CAMPOBELLO ISLAND
0 10 20 30 40
Kilometres
GRAND MANAN
Magor division boundary
Minor division boundary
Subdivision boundary

Fig 1.3 - Physiography of southwestern New Brunswick (after Rampton et al., 1984) with study area highlighted.

Drainage of the study area is facilitated via three main drainageways: the St. Croix River; The Digdeguash River; and the Magaguadavic River, all of which flow south-southeastward towards the Bay of Fundy. These rivers, as well as many secondary and tertiary streams are aligned with the northwest-southeast trending ridges and valleys, therefore defining a parallel drainage pattern (Rampton et al., 1984). In broad depressions (e.g., Canoose Flowage, Upper Canoose Flowage; Fig. 1.2a, Plate 1.1) drainage is poor and deranged.

1.4 Bedrock Geology

The Rollingdam study area (NTS 21 G/06) lies almost entirely within the Magaguadavic tectonostratigraphic zone of New Brunswick (Ruitenberg et al., 1977; Fyffe, 1982a, 1982b) (Fig. 1.4). However, a small part of the Central Platform tectonostratigraphic zone protrudes the northeastern corner of the map area (Fig. 1.4). This occurrence of the Central Platform zone is of Carboniferous age and is assigned to the Shin Formation (Fyffe, 1997 and references therein). The Magaguadavic zone is comprised of metamorphosed Ordovician, Silurian, and late Silurian sedimentary rocks and associated volcanic rocks which were later intruded by granitoid rocks of Devonian age (Ruitenberg et al., 1977; Ruitenberg and McCutcheon, 1982; Fyffe, 1997). These rocks have been assigned to specific groups and formations based on their lithology, structure and age by previous workers (e.g., Ruitenberg, 1967; Fyffe, 1997).

Fyffe and Fricker (1987), in their tectonostratigraphic terrane analysis of New Brunswick, subdivide the study area into two distinct terranes. The Honeydale Fault system, which runs NE-SW diagonally across the study area (Fig. 1.5), defines the boundary between the St. Croix terrane to the southeast and the Fredericton Cover

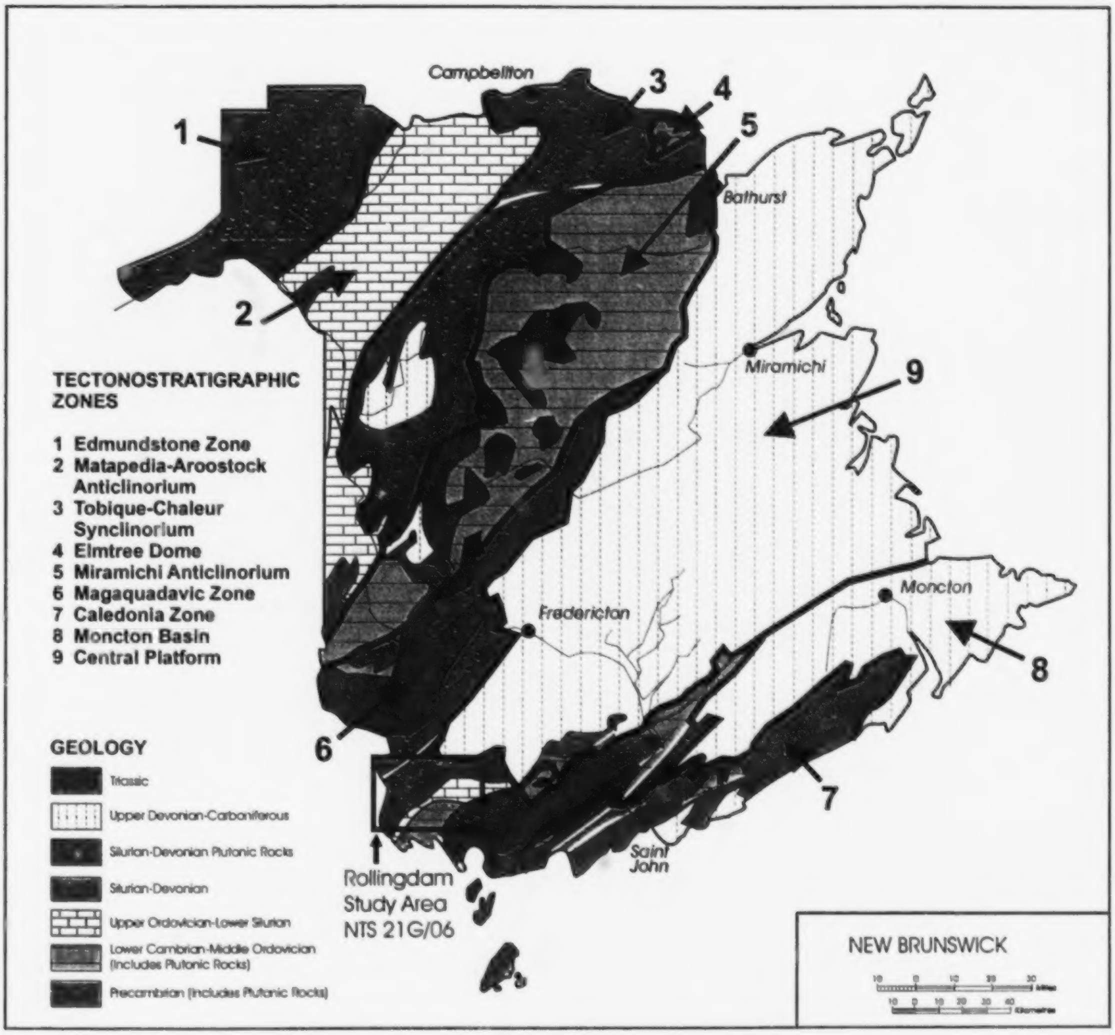

Campbellton
1
2
3
4
5
Bathurst
Miramichi
9
Fredericton
Moncton
8
6
7
Saint John
Rollingdam Study Area NTS 21G/06
TECTONOSTRATIGRAPHIC ZONES
1 Edmundstone Zone
2 Matapedia-Aroostock Anticlinorium
3 Tobique-Chaleur Synclinorium
4 Elmtree Dome
5 Miramichi Anticlinorium
6 Magaquadavic Zone
7 Caledonia Zone
8 Moncton Basin
9 Central Platform
GEOLOGY
Triassic
Upper Devonian-Carboniferous
Silurian-Devonian Plutonic Rocks
Silurian-Devonian
Upper Ordovician-Lower Silurian
Lower Cambrian-Middle Ordovician (Includes Plutonic Rocks)
Precambrian (Includes Plutonic Rocks)
NEW BRUNSWICK
10 0 10 20 30
10 0 10 20 30 40

Fig. 1.4 - Tectonostratigraphic zones of New Brunswick (after Ruitenberg et al., 1977; Potter et al., 1979; Fyffe, 1982a,b; Rampton et al., 1984)

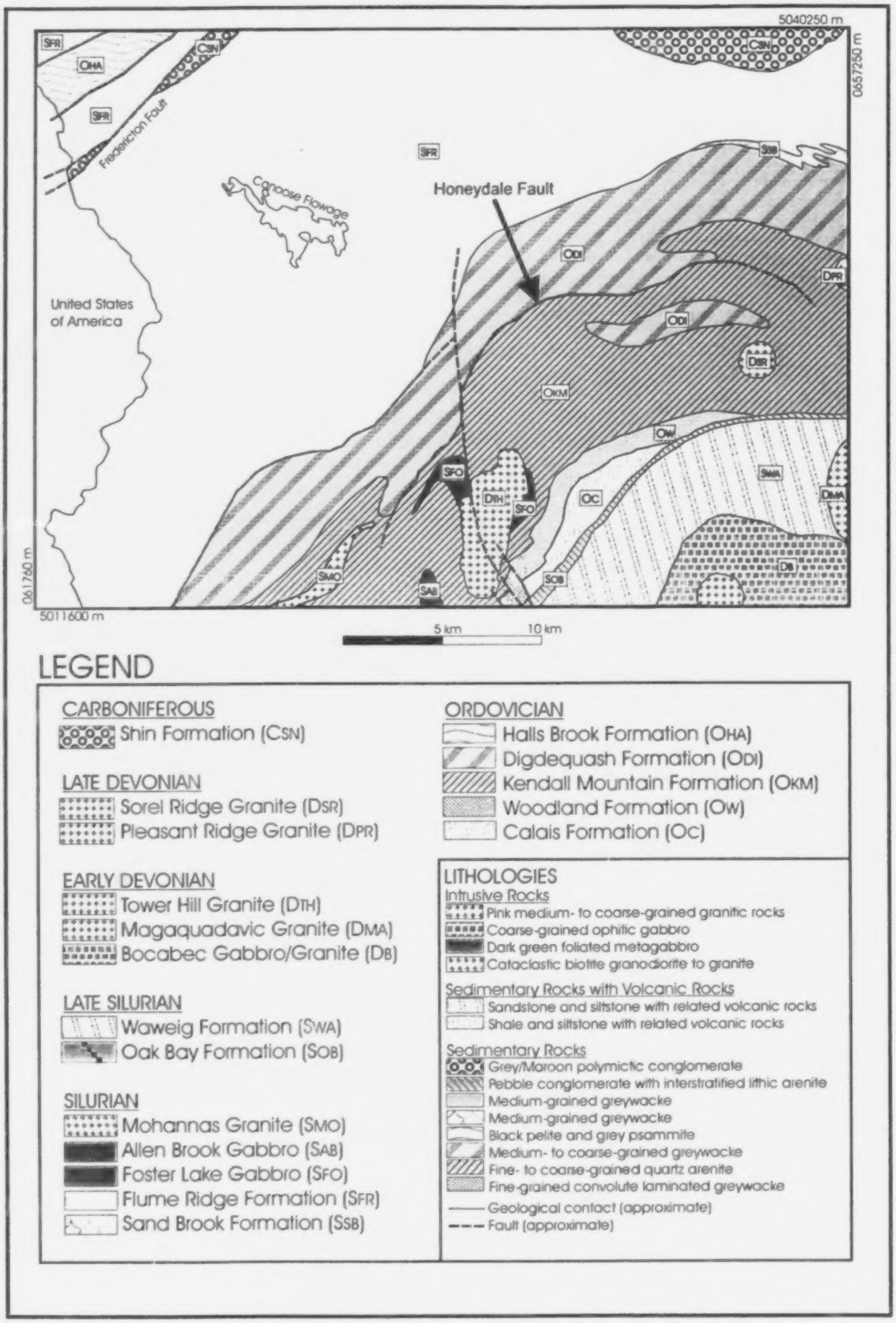

5040250 m
0657250 m
SFR
OHA
CSN
SFR
Fredericton Fault
SFR
Canoose Flowage
Honeydale Fault
SSB
ODI
DPR
ODI
DSR
United States of America
OKM
OW
SWA
SFO
DTH
SFO
OC
DMA
DB
SMO
SAB
SOB
061760 m
5011600 m
5 km
10 km
LEGEND
CARBONIFEROUS
Shin Formation (CSN)
LATE DEVONIAN
Sorel Ridge Granite (DSR)
Pleasant Ridge Granite (DPR)
EARLY DEVONIAN
Tower Hill Granite (DTH)
Magaquadavic Granite (DMA)
Bocabec Gabbro/Granite (DB)
LATE SILURIAN
Waweig Formation (SWA)
Oak Bay Formation (SOB)
SILURIAN
Mohannas Granite (SMO)
Allen Brook Gabbro (SAB)
Foster Lake Gabbro (SFO)
Flume Ridge Formation (SFR)
Sand Brook Formation (SSB)
ORDOVICIAN
Halls Brook Formation (OHA)
Digdequash Formation (ODI)
Kendall Mountain Formation (OKM)
Woodland Formation (OW)
Calais Formation (OC)
LITHOLOGIES
Intrusive Rocks
Pink medium- to coarse-grained granitic rocks
Coarse-grained ophitic gabbro
Dark green foliated metagabbro
Cataclastic biotite granodiorite to granite
Sedimentary Rocks with Volcanic Rocks
Sandstone and siltstone with related volcanic rocks
Shale and siltstone with related volcanic rocks
Sedimentary Rocks
Grey/Maroon polymictic conglomerate
Pebble conglomerate with interstratified lithic arenite
Medium-grained greywacke
Medium-grained greywacke
Black pelite and grey psammite
Medium- to coarse-grained greywacke
Fine- to coarse-grained quartz arenite
Fine-grained convolute laminated greywacke
Geological contact (approximate)
Fault (approximate)

Fig. 1.5 - Generalized bedrock geology of the study area (after Fyffe, 1997).

Sequence to the northwest. The cover rocks are mainly deep water lithic and quartzose turbidites of Ordovician and Silurian age (Flume Ridge Formation and Digdeguash Formation; Fig. 1.5), (Fyffe and Fricker, 1987; Fyffe 1997). Specifically the Flume Ridge Formation (Silurian) consists of micaceous and calcareous sandstones interbedded with non-calcareous siltstone and shale, while the Digedeguash Formation (Ordovician) is comprised of pelites and psammites (Fyffe, 1997).

The St. Croix terrane is subdivided into the Cookson Group and the Mascarene Group (Fyffe and Fricker, 1987; Fyffe, 1997). The Cookson Group is Ordovician in age, being characterized by black slates, quartzites and minor volcanic rocks. The late Silurian Mascarene Group, which unconformably overlies the Cookson Group, is comprised of the Oak Bay Formation conglomerate and Waweig Formation sandstones with associated volcanic rocks (Fyffe and Fricker, 1987; Fyffe 1997). Intruding the rocks of the Cookson and Mascarene groups are a series of early and late Devonian granitoid bodies. The Cookson Group was also affected by Silurian-age granitic and gabbroic intrusions.

1.4.1 Mineral Occurrences

There are eleven documented mineral occurrences throughout the Rollingdam map area (Fig. 1.6); most of which can be found in the St. Croix terrane, south of the Honeydale Fault system. The area is host to a variety of deposit types, characteristic of a wide range of commodities, making the area attractive for further exploration (Fig. 1.6).

Epigenetic gold deposits have been documented in the area in the past (e.g., Lower Tower Hill-Waweig Au-Ag-Zn-Pb-Cu; Moores Mills #2 Ag-Cu-Pb) (Fig. 1.6) and recent exploration has led to a marked increase in interest and staking throughout the

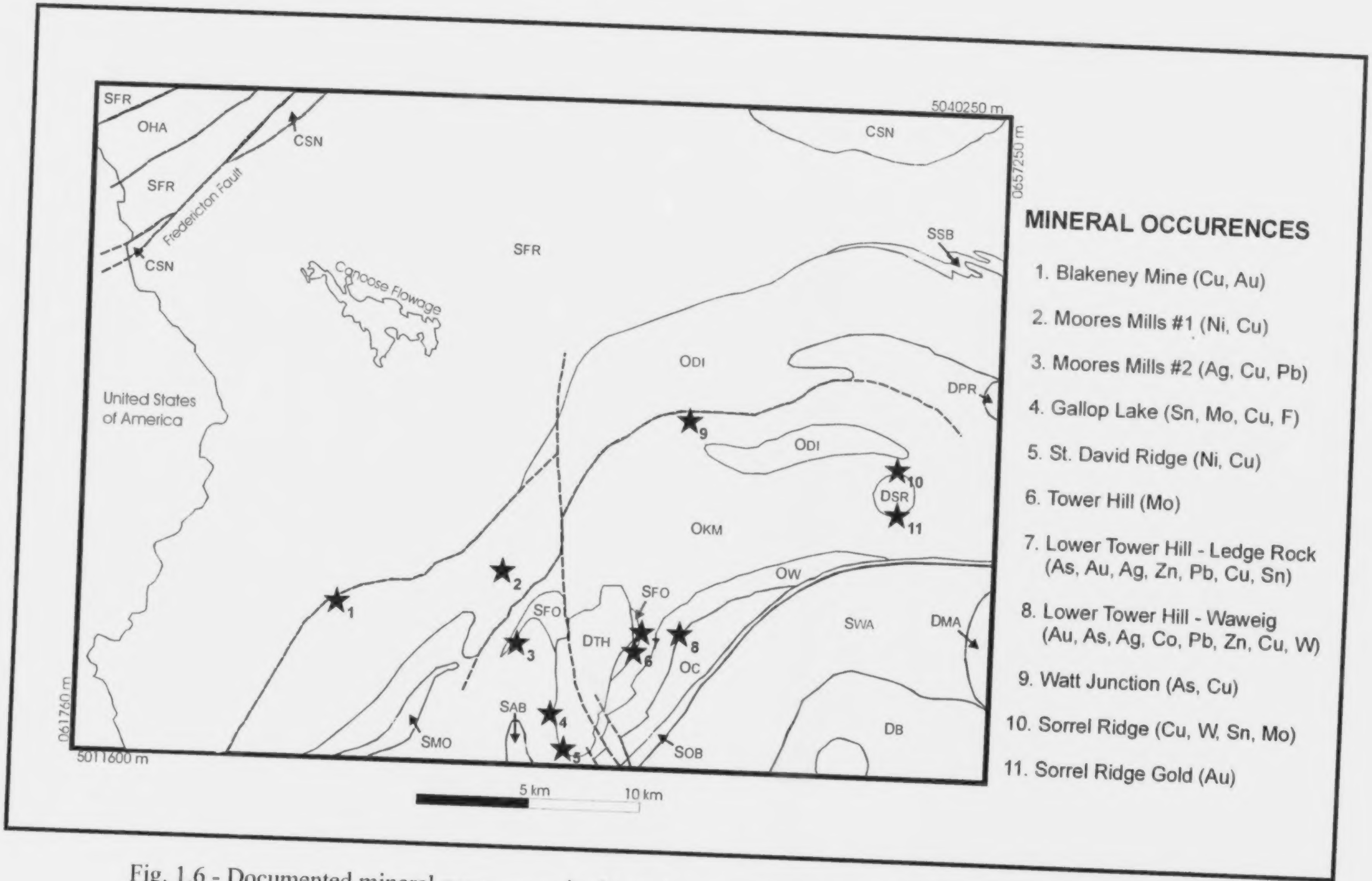

SFR
OHA
CSN
SFR
Fredericton Fault
CSN
SFR
Canoose Flowage
United States of America
5040250 m
0657250 m
061760 m
5011600 m
CSN
SSB
ODI
DPR
ODI
OKM
DSR
OW
SFO
SFO
DTH
SWA
DMA
OC
SAB
SMO
SOB
DB
1
2
3
4
5
6
7
8
9
10
11
5 km
10 km
MINERAL OCCURENCES
1. Blakeney Mine (Cu, Au)
2. Moores Mills #1 (Ni, Cu)
3. Moores Mills #2 (Ag, Cu, Pb)
4. Gallop Lake (Sn, Mo, Cu, F)
5. St. David Ridge (Ni, Cu)
6. Tower Hill (Mo)
7. Lower Tower Hill - Ledge Rock (As, Au, Ag, Zn, Pb, Cu, Sn)
8. Lower Tower Hill - Waweig (Au, As, Ag, Co, Pb, Zn, Cu, W)
9. Watt Junction (As, Cu)
10. Sorrel Ridge (Cu, W, Sn, Mo)
11. Sorrel Ridge Gold (Au)

Fig. 1.6 - Documented mineral occurrences in the study area. Refer to Fig. 1.5 for descriptions of bedrock units.

area. In the St. Croix terrane, gold seems to be associated, but not restricted to, quartz veins in Ordovician/Silurian sedimentary rocks and mafic volcanic rocks (Ruitenberg and McCutcheon, 1994). The proposed genetic model for these types of deposits involves metamorphic dehydration reactions where auriferous carbon dioxide-rich fluid derived from mafic magmas or the lower crust during metamorphism is released in dilatent structures at various levels in the crust (Ruitenberg and McCutcheon, 1994).

Nickel-Cobalt-Copper type deposits are also found in the study area (e.g., St. David Ridge Ni-Cu; Moores Mills #1 Ni-Cu; Fig. 1.6). These deposits are hosted in early Devonian mafic to ultramafic intrusions which protrude sulphide-bearing Ordovician metasedimentary rocks. Ruitenberg and McCutcheon (1994) note that these deposits were formed when relatively primitive magma was contaminated by sulphide-rich metasedimentary rocks, resulting in sulphur saturation and hence deposition within mafic to ultramafic intrusions.

Tin-tungsten type deposits have also been delineated (e.g. Sorrel Ridge Cu-W-Sn; Gallop Lake Sn, Mo, Cu; Fig. 1.6) and are hosted within late Devonian silica-rich granites and their related contact aureoles (Ruitenberg and McCutcheon, 1994). Specifically, deposits of this type seem to be situated in faults, fractures and breccias within the above mentioned host environment.

CHAPTER 2

PREVIOUS WORK

2.1 Glacial Studies in southwest New Brunswick

Preliminary work describing the glacial history of southwestern New Brunswick began as early as the mid-1800s by James Robb (1851), H.Y. Hind (1865), and G.F. Matthew (1872, 1879). By making note of glacial striae orientation throughout the course of their bedrock examinations, they adopted the idea that glaciation comprised one mass of ice flowing in a south-southeasterly direction.

Chalmers (1890) expanded upon this concept by proposing that the province was glaciated by an "Appalachian system of glaciers" rather than by one vast ice cap. Furthermore, he postulated that striae indicating south-southeasterly flow, observed in southwestern New Brunswick, were the result of glaciation by local ice caps centered in the highlands of New Brunswick and New England (Chalmers, 1890).

Lee (1957, 1962) was among the first to characterize and map surficial materials in southwestern New Brunswick, although Wicklund and Langmaid (1953) conducted an earlier regional soil survey that provided some information regarding glacigenic sediments and their relevance to the genesis and physical attributes of overlying soils. More recent work by Gadd (1973) and Rampton et al. (1984) described the composition and extent of surficial materials while also providing a comprehensive interpretation of glacial history.

Rampton et al. (1984) also revised Chalmers' hypothesis of an "Appalachian system of glaciers" by suggesting that four local ice centres affected New Brunswick during the Late Wisconsinan. Two of these, the North Maine/Notre Dame Ice Divide centred in the highlands of Maine (White Mountains, Megantic Hills, Gaspé Peninsula), and the proposed Gaspereau Ice Centre centered within the New Brunswick Lowlands, are thought to have impinged upon southwestern New Brunswick (Rampton et al., 1984). Follow-up studies by Seaman (1989a, 1989b) and Seaman et al. (1993) characterized the extent and chronology of erosional ice-flow events through an extensive analysis of striated outcrops. From this work Seaman et al. (1993) concluded that the glacial history of southwestern New Brunswick was more complex than previously envisioned.

2.2 Glacial Studies in the Rollingdam area (NTS 21G/06)

The study area has been mapped as part of regional scale surficial material surveys conducted by Gadd (1973b), Wicklund and Langmaid (1953), and Rampton et al. (1984). Work done by Seaman (1989a, 1989b, 1989c), characterizing the timing and direction of ice-flow events in southwestern New Brunswick, also included the Rollingdam area. Although the Rollingdam area was included in these previous regional surveys, there has been a paucity of work concerning surficial geology and geochemical dispersal at a local scale.

The complex glacial history of the area has previously inhibited the use of till studies as a tool for drift prospecting. The abundance of stagnation and deglacial features, such as blankets of hummocky ablation till and sequences of ice-contact/glaciofluvial deposits (Plate 2.1) coupled with multiple ice-flow directions, poses a hindrance to understanding till provenance in the area. Previously, only Chiswell (1992) has attempted to delineate lithological and geochemical dispersion in till within the Rollingdam area.

Plate 2.1 - Section of ice-contact sediment located just north of Fahey's Hill (Fig. 1.2a).

CHAPTER 3

METHODOLOGY

3.1 Field Methods

The New Brunswick Department of Natural Resources and Energy undertook sample collection of glacigenic sediments during the field season of 2001. Follow-up work including re-sampling and till fabric analysis was conducted during June and July 2002. Samplers included project supervisor, Toon Pronk; Rex Boldon; the author; as well as field assistants K. Knorr, M. Doiron, and R. Richard. Site locations were based on a 2km grid (one sample per 4km^2) established by means of the UTM co-ordinate system (Appendix 1).

Using stainless steel equipment, a total of 272 till samples, including five duplicates and nine alternates, were collected from natural exposures, road-cuts, and hand-dug excavations (Fig. 1.7). Duplicates were collected to ensure quality control and consistency in sampling procedures. Sample material was obtained from the C-horizon at a mean depth of 0.75m and consisted of matrix and clast material separated into two plastic bags. Plate 3.1 shows a typical soil profile at a road-cut exposure. Typically 60 to 100 clasts were collected, ranging in size from 2 cm to 10 cm in diameter. Also, a detailed site card was completed at each site that involved systematically tabulating information regarding the texture, consistency and colour of the sample material, soil profile characteristics, as well as information concerning local drainage and vegetation.

In conjunction with the sampling program, attention was given to the examination of ice-flow directional indicators. Accurate measurements of striae, micro-fluting, crag

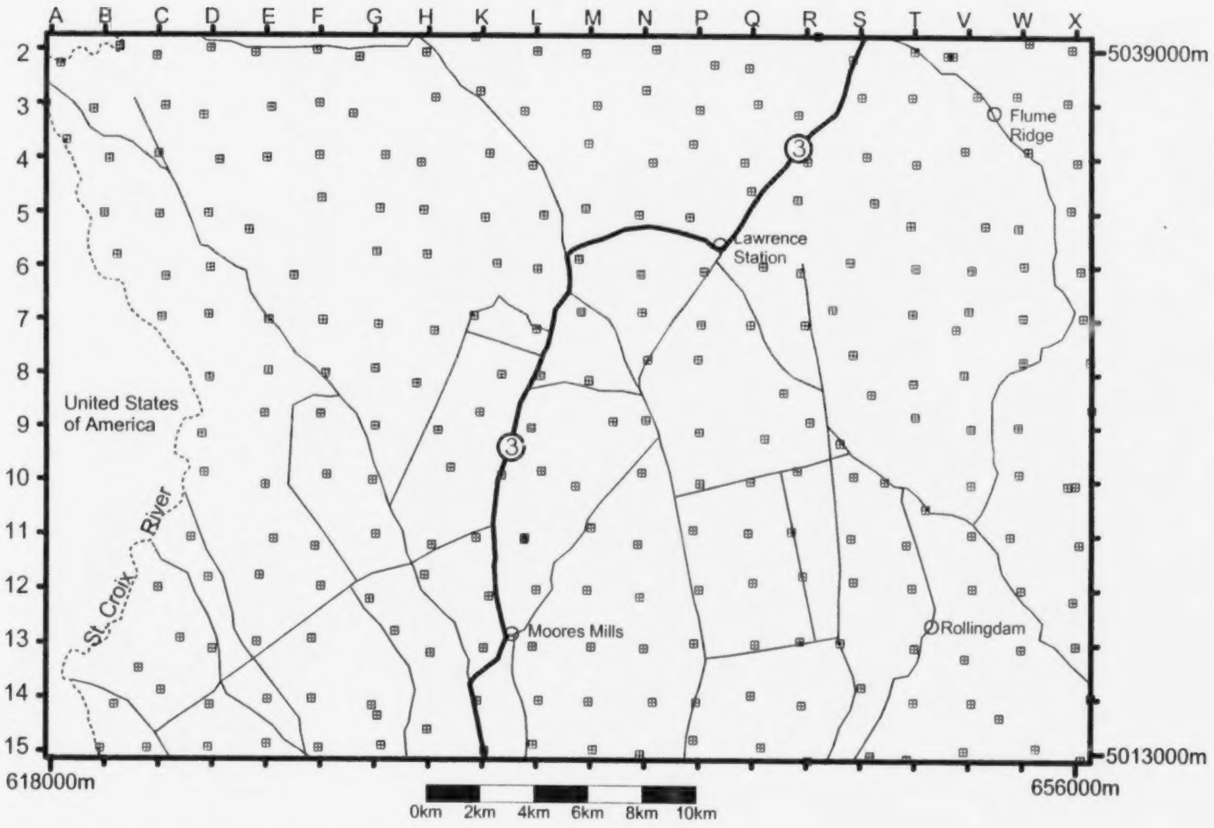

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
Flume Ridge
Lawrence Station
3
3
United States of America
St. Croix River
Moores Mills
Rollingdam
0km
2km
4km
6km
8km
10km

Fig. 3.1 - Sample site locations in the Rollingdam study area (NTS 21 G/06)

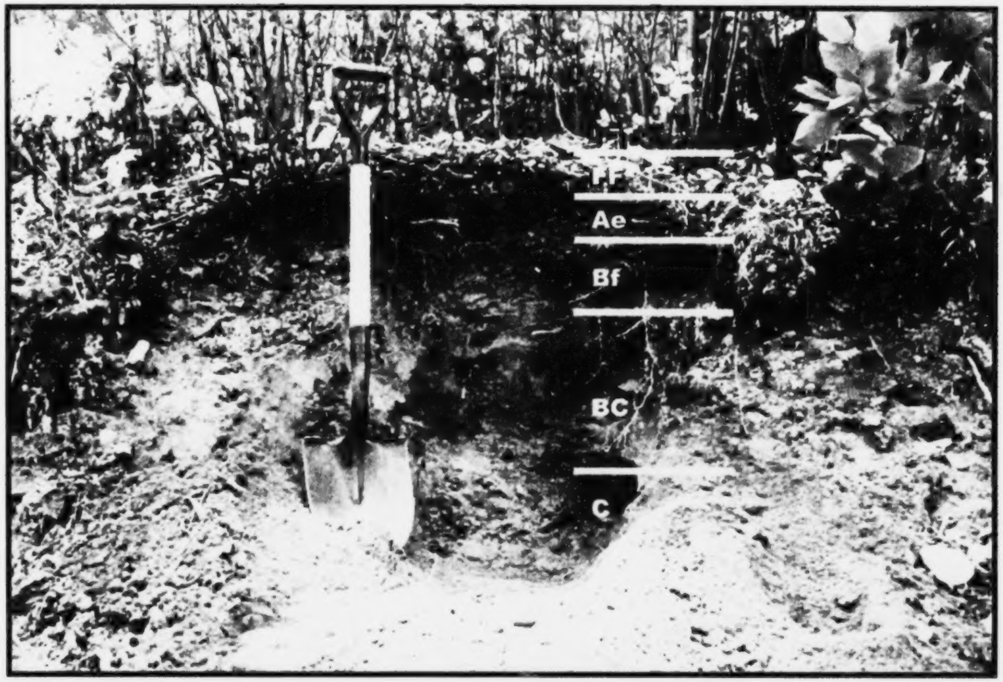


Plate 3.1 - Typical soil profile of the study area. The horizons present are the forest floor (FF), leached zone (Ae), enriched zone (Bf), transition zone (BC), and the parent material (C). In this case the parent material is ablation till.

and tails, crescentic fractures, and other glacigenic erosional features were conducted upon discovery and where possible, chronological relationships were established. Also, till fabric analysis was conducted at four localities within the study area. Sections of lodgement till were selected for analysis only if the following criteria were met: (1) sub-vertical profile (road cut or excavation); (2) matrix-supported fabric; (3) high degree of compactness; and (4) practical availability of elongated clasts. A total of 25 clasts exhibiting a 1.5:1 or greater length-to-width ratio were examined at three of the sites; 20 clasts meeting this requirement were examined at the fourth site. Clasts were characterized in terms of spatial orientation, dip, length of long axis, and width.

3.2 Laboratory Methods

Laboratory procedures involved geochemical, lithological and granulometric analysis of 272 till samples. Considerable sample preparation of the till samples was required to facilitate geochemical and granulometric analysis. Samples were first dried in low temperature ovens to remove moisture and then dry sieved to the clay plus silt fraction (<0.063 mm) for geochemical analysis, and to the sand plus silt plus clay fraction (<2 mm) for granulometric analysis. Fifty grams of the <2 mm material were weighed out for each sample as required for granulometric analysis (Appendix 2).

Geochemical analysis of the till samples involved both Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Instrumental Neutron Activation Analysis (INAA). ACME Analytical Laboratories®, Vancouver, British Columbia, performed ICP-MS analysis for 37 base metal and trace element concentrations (Table 3.1) using their patented Ultratrace ICP-MS technique. To determine the concentrations of these elements a one-gram sample was first leached with 6 ml of solution containing HCl,

HNO_3 and deionized water at 95° C for one hour. The sample was then diluted and analyzed by ICP-MS.

INAA was conducted by Becquerel Laboratories®, Mississauga, Ontario. Samples were irradiated with neutron flux monitors in a two-megawatt reactor and after a seven-day decay period, measured using a high-resolution germanium detector. Elements analyzed included: Ag, As, Au, Ba, Br, Cd, Ce, Co, Cr, Cs, Eu, Fe, Hf, Ir, La, Lu, Mo, Na, Ni, Rb, Sb, Sc, Se, Sm, Sn, Ta, Tb, Te, Th, U, W, Yb, Zn, and Zr. Data for Ag, Cd, Ir, Mo, Ni, Se, Sn, Te, Zn, and Zr are not presented here due to inadequate detection limits or precision. Detection limits of those elements showing adequate precision are listed in Table 3.2. For a complete evaluation of the precision and accuracy of the geochemical data presented in this report refer to Appendix 4, Part C.

Because lithological analysis of the till samples was conducted on the clast component only, no significant sample preparation was required, as clasts sized between 2 and 10 cm in diameter were hand-separated from till samples in the field. After a thorough cleaning by water under high-pressure, these clasts were examined and then categorized on the basis of lithology. When necessary, clasts were cut or split to expose a fresh surface.

Results of the clast identifications are presented as percent concentrations of specific lithologies relative to the total clast count. For example, if for a particular site there are 20 grey sandstone clasts, and the total clast count is 80 then the grey sandstone concentration for that site is 25 percent. A summary of the lithological results is presented in Appendix 3 (see Chapter 5.0, section 5.3, for contour plots of specific clast lithologies showing significant dispersal patterns). D. V. Venugopal, A. G. (Toon) Pronk

Element	Detection Limit	Element	Detection Limit	Element	Detection Limit
Au	0.2 ppb	Mo	0.01 ppm	Sb	0.02 ppm
Ag	2 ppb	Na	0.001 %	Sc	0.1 ppm
Al	0.01 %	Ni	0.1 ppm	Se	0.1 ppm
As	0.1 ppm	P	0.001 %	Sr	0.5 ppm
B	1 ppm	Pb	0.01 ppm	Te	0.02 ppm
Ba	0.5 ppm	S	0.02 %	Th	0.1 ppm
Bi	0.02 ppm	Hg	5 ppb	Ti	0.001 %
Ca	0.01 %	Ga	0.1 ppm	Tl	0.02 ppm
Cd	0.01 ppm	K	0.01 %	U	0.1 ppm
Co	0.1 ppm	La	0.5 ppm	V	2 ppm
Cr	0.5 ppm	Mg	0.01 %	W	0.1 ppm
Cu	0.01 ppm	Mn	1 ppm	Zn	0.1 ppm
Fe	0.01 %				

Table 3.1 – Elements analyzed by ICP-MS and their corresponding detection limits as defined by ACME Analytical Laboratories®.

Element	Detection Limit	Element	Detection Limit	Element	Detection Limit
As	0.5 ppm	Eu	1 ppm	Sc	0.2 ppm
Au	2 ppb	Fe	0.2 %	Sm	0.1 ppm
Ba	50 ppm	Hf	1 ppm	Ta	0.5 ppm
Br	0.5 ppm	La	2 ppm	Tb	0.5 ppm
Ce	5 ppm	Lu	0.2 ppm	Th	0.2 ppm
Co	5 ppm	Na	0.02 %	U	0.2 ppm
Cr	20 ppm	Rb	5 ppm	W	1 ppm
Cs	0.5 ppm	Sb	0.1 ppm	Yb	2 ppm

Table 3.2 – Elements analyzed by INAA presented in this report and their corresponding detection limit as defined by Bequerel Laboratories®.

and Allen Seaman from the New Brunswick Department of Natural Resources and Energy, aided the author in identifying or confirming the lithology of problem clasts.

Rex Boldon and the author, using a modified hydrometer method after Bouyoucos (1962), performed granulometric analysis on the <2mm fraction to quantify the relative amount of sand, silt, and clay in each of the 272 till samples. For a detailed description of the methodology used refer to Appendix 5.

3.3 Statistical Methods

To examine the data obtained from granulometric, lithological and geochemical analyses for patterns of dispersal and other emergent trends the SURFER 6.01® contouring program was used. This spatial representation of the data allowed for the areal distribution of each specific variable across the study area to be presented in a visual format. Granulometric, lithological and geochemical data are presented as contour maps using the point kriging method of contouring.

Point kriging estimates the values at grid nodes by using a moving-average technique of contouring, thereby compensating for the somewhat irregular spacing of the sample sites. Statistically, kriging is based on the 'theory of regionalized variables'. A variable is considered a 'regionalized variable' if it varies from one place to another with apparent continuity. Such is the case with geochemical data. Granulometric data is also presented as post maps using proportional scaling (linear scaling method) where post size is proportional to its corresponding value. To examine the till fabric data for evidence of trend, rose diagrams were constructed using the Oriana for Windows 1.06® program.

Two genetically different types of till (basal till and ablation till) belonging to distinct statistical populations were collected from the study area; therefore the question of how to treat these data had to be addressed. Because approximately 20% of the samples collected were ablation till, and excluding them would create significant gaps in the data, it was decided that data would be contoured as a whole (including ablation till data) for the lithological, geochemical, and granulometric component plots. Past studies (e.g., Balzer, 1992; Stumpf, 1995) have shown that ablation tills found in southwestern New Brunswick are of local derivation, comparable to that of basal tills found in the area.

Statistical analyses using Microsoft Excel '97® were performed on all 49 elements analyzed. The mean value, standard deviation, skewness, kurtosis, and percentiles, as well as a histogram, were reported for each element (Appendix 5). Data processing was conducted on the basal till population alone, but for comparative purposes, statistical analyses were also carried out on the combined basal till and ablation till data groupings. The result of this exercise demonstrates that there is in fact no significant shift in the data set if the ablation till is included with the basal till.

The basal till population was also split into two "sub-populations" for comparative purposes. Fyffe and Fricker (1987), in their tectonostratigraphic terrane analysis of New Brunswick, characterize the Honeydale Fault system, which transects the study area, as the boundary between the St. Croix Terrane to the southeast and the Fredericton Cover Sequence to the northwest. By treating the basal till in these different terranes as separate populations (although genetically equivalent), it could be established whether background geochemical values vary between the two terranes. Also, Spearman's Rank Correlation analysis was conducted on all geochemical, lithological, and granulometric data to examine for both correlations within each data set and interrelations between data sets (Chapter 5, section 5.5). The program WinSTAT® for Microsoft Excel Version 2001.1 was used to facilitate this examination.

CHAPTER 4

CURRENT GLACIAL THEORIES

Wisconsinan glacier dynamics greatly affected the distribution of surficial materials in southwestern New Brunswick and must be considered when delineating regolith geochemical dispersal patterns. Without an understanding of ice-flow events which traversed the study area and the mechanics involved in deglaciation it would be difficult to interpret the results of a till geochemistry survey (Shilts, 1975). Models developed by previous workers (e.g., Gadd, 1973; Rampton et al., 1984) have been successful in describing the complex glacial history of southwestern New Brunswick at a regional scale, although continued study is required to fully comprehend local history.

It has been theorized (Rampton et al., 1984) that the Laurentide Ice Sheet did not penetrate southwestern New Brunswick during the Wisconsinan. Instead, local ice centres, some of which produced the erosional and depositional features characteristic of southwestern New Brunswick, likely blocked Laurentide ice from inundating the area. The location, timing and interrelation of these ice centres and their affect on southwestern New Brunswick is described within this chapter.

Conflicting scenarios exist regarding the deglaciation of southwestern New Brunswick. Seaman et al. (1993) suggested that deglaciation occurred by means of regional scale stagnation, although a step-like retreat pattern was proposed by Gadd (1973). Both theories are examined herein.

4.1 Glaciation of southwestern New Brunswick

In accordance with Rampton et al. (1984), the Quaternary history of the province can be divided into three distinct intervals: (1) the pre- Late Wisconsinan (>20 ka B.P.), (2) the Late Wisconsinan (approximately 20-10 ka B.P.), and (3) the Holocene (10 ka to present). Major fluctuations in glaciers, water levels and land levels recognizably occurred during the Late Wisconsinan. In contrast, only limited evidence of Early Wisconsinan glaciation has been found (Rampton et al., 1984); however, it is suspected that major glacial erosion and deposition occurred in parts of New Brunswick during this period (Seaman et al. 1993). No evidence of pre-Wisconsinan glaciation has been reported in the province. The Holocene marks geological events following the end of glacial activity.

4.1.1 Pre- Late Wisconsinan Glaciation

The lack of well-preserved stratigraphic units within southwestern New Brunswick makes it difficult to interpret the pre- Late Wisconsinan history. However, Rampton et al. (1984) allege that an easterly ice-flow event emanating from the White Mountains of central Maine and crossing southern New Brunswick, may be of Early Wisconsinan age. Also, Rampton et al. (1984) attribute southeasterly trending striae found in southeastern New Brunswick to ice activity during the Early Wisconsinan and term this the Caledonia flow pattern or Caledonia phase of glaciation (>53 ka B.P.). Seaman et al. (1993) expand on this and suggest that the dominant southeasterly trending striae and glacial landforms characteristic of southwestern New Brunswick, which parallel to those of southeastern New Brunswick, are also the result of the Caledonia phase glaciation.

4.1.2 Late Wisconsinan Glaciation

Late Wisconsinan glaciation in New Brunswick was accomplished by ice activity from four local ice centres. Rampton et al. (1984) termed the ice centres the Escuminac Ice Centre; Gaspereau Ice Centre; North Maine Ice Divide; and the Notre Dame Mountain Ice Centre. Only North Maine ice and Gaspereau ice impinged upon southwestern New Brunswick.

The Late Wisconsinan has been divided into six phases based on variable ice centre activity (Rampton et al., 1984). In chronological order these are: (1) the Chignecto phase; (2) the Bantalor phase; (3) the Millville/Dungarvon phase; (4) the Plaster Rock phase; (5) the Chaleur phase; and (6) the Madawaska phase.

The Chignecto phase (15 to 18 ka B.P.) had only limited affect on southwestern New Brunswick including the study area. The Escuminac Ice Centre, an ice cap centred off the north shore of Prince Edward Island, is believed to have been dominant at this time, actively causing ice to flow south as far as Chignecto Bay and northwest across the Acadian peninsula (Fig. 4.1; Rampton et al. (1984)). The North Maine Ice Divide (Fig. 4.1; Rampton et al. (1984)), was also active during this period, likely preventing the intrusion of the Laurentide ice sheet into New Brunswick and possibly causing ice to flow in a southeasterly direction over part of the Rollingdam map area (Rampton et al., 1984).

During the Bantalor phase (15 to 13.5 ka B.P.) all of southwestern New Brunswick, including the study area, was greatly affected by ice (Fig. 4.2; Rampton et al., 1984). Southeasterly flowing ice originating from the North Maine Ice Divide traveled across much of the western and southwestern portions of the province. In addition to this, the proposed Gaspereau Ice Centre was actively causing ice to flow southward from the New Brunswick Lowlands, across parts of southwestern New Brunswick (likely including the eastern portion of the study area) towards the Bay of Fundy (Rampton et al., 1984). Evidence of southeasterly and southerly ice-flow patterns are widespread throughout southwestern New Brunswick and likely define the nature of the contact between Gaspereau and North Maine derived ice masses (Fig. 4.2).

Gadd (1973) noted that much of the western half of southwestern New Brunswick is dominated by southeasterly trending drumlinoid features and striations while the eastern half is characteristic of southerly trending striations. This was confirmed through observations made by the author during fieldwork in the area. A substantial shift in striae orientation, from a southeasterly trend (~140°) to southerly (~172°) or south-southwesterly trend (~210°), occurs in the area along the eastern border of the Rollingdam map sheet.

Seaman (1989c) defined the extent and variability of ice-flow patterns in this area in an attempt to characterize the contact between the North Maine and Gaspereau ice masses. It became apparent to Seaman (1989c), with 14 potentially different ice-flow patterns being identified, that the complexity of the glacial history was greater than previously interpreted. Seaman (1989c) did, however, provide a chronology of these ice-flow patterns stating that the oldest "positively identified" ice-flow event trended 165° (south-southeast). Seaman et al. (1993) correlated this trend with Gaspereau Ice Centre activity (Chignecto phase), hence implying that ice from the Gaspereau Ice Centre traversed southwestern New Brunswick before ice from the North Maine Ice Divide.

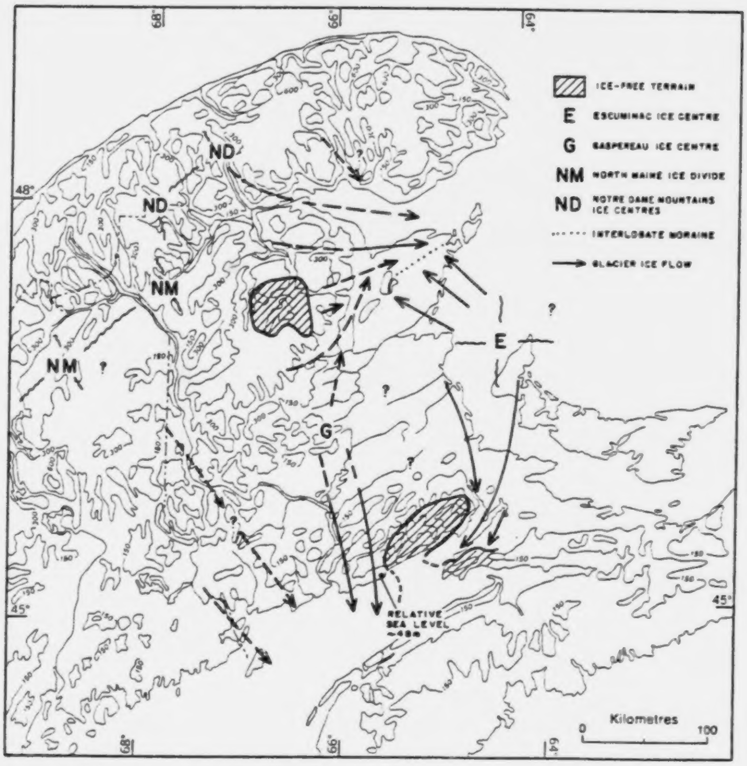
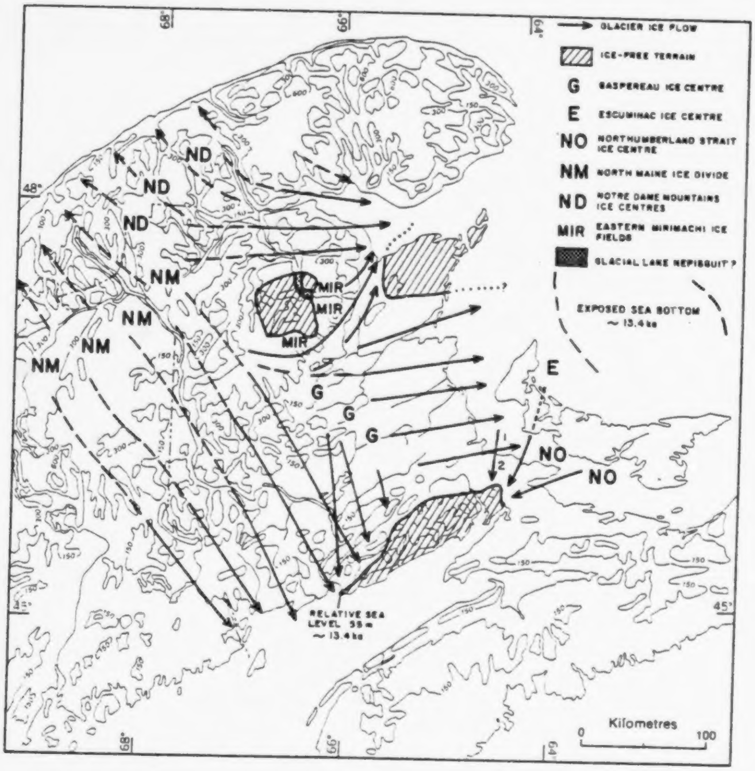

68°
66°
64°
48°
45°
▨ ICE-FREE TERRAIN
E ESCUMINAC ICE CENTRE
G GASPEREAU ICE CENTRE
NM NORTH MAINE ICE DIVIDE
ND NOTRE DAME MOUNTAINS ICE CENTRES
INTERLOBATE MORAINE
GLACIER ICE FLOW
ND
ND
NM
NM
E
G
?
RELATIVE SEA LEVEL
Kilometres
0
100

Fig. 4.1 – Ice-flow directions during the Chignecto phase (after Rampton et al., 1984).



68°
66°
64°
48°
45°
GLACIER ICE FLOW
ICE-FREE TERRAIN
G GASPEREAU ICE CENTRE
E ESCUMINAC ICE CENTRE
NO NORTHUMBERLAND STRAIT ICE CENTRE
NM NORTH MAINE ICE DIVIDE
ND NOTRE DAME MOUNTAINS ICE CENTRES
MIR EASTERN MIRIMACHI ICE FIELDS
GLACIAL LAKE NEPISGUIT ?
EXPOSED SEA BOTTOM ~ 13.4 ka
ND
ND
ND
NM
NM
NM
NM
MIR
MIR
MIR
G
G
G
E
NO
NO
1
2
RELATIVE SEA LEVEL 55 m ~ 13.4 ka
Kilometres
0
100

Fig. 4.2 – Ice-flow directions during maximum extent of the Bantalor phase (after Rampton et al., 1984).

According to Seaman et al. (1993) two following ice-flow events, trending 150° and 140°, were the result of North Maine Ice Divide activity. This shows that there was no interaction between these ice masses, and hence implies that the activity of the ice centres was independent of each other.

In contrast, Rampton et al. (1984) concluded that the North Maine and Gaspereau ice masses were active contemporaneously. Rampton et al. (1984) suggested that the contact between these ice masses defined a dynamic system, in effect during the Bantalor phase, where North Maine ice flow alternated with flow from the Gaspereau Ice Centre. However, the absence of an interlobate moraine in the study area indicates that the North Maine and Gaspereau ice masses may have existed independently of each other, if they were distinct ice masses. Seaman and Pronk (oral communication, Oct., 2001) have proposed the possibility that ice derived from the North Maine Ice Divide may have been capable of producing both the southerly and southeasterly flow directions characteristic of southwestern New Brunswick. This potentially negates the effect of southerly flowing ice derived from the proposed Gaspereau Ice Centre (see Chapter 6, section 6.2).

The Millville/Dungarvon phase (12.7 ka B.P.) followed the Bantalor phase and had only limited effect on southwestern New Brunswick (Fig. 4.3; Rampton et al., 1984.) During this time the ice margin retreated from the Bay of Fundy towards the northwest, allowing much of southern and eastern New Brunswick to become ice-free. Throughout this phase southerly trending ice derived from the North Maine Ice Divide occupied western New Brunswick and impinged only on the McAdam (NTS 21G/11) and Canterbury (NTS 21G/14) areas of southwestern New Brunswick (Fig. 4.3; Rampton et al., 1984).

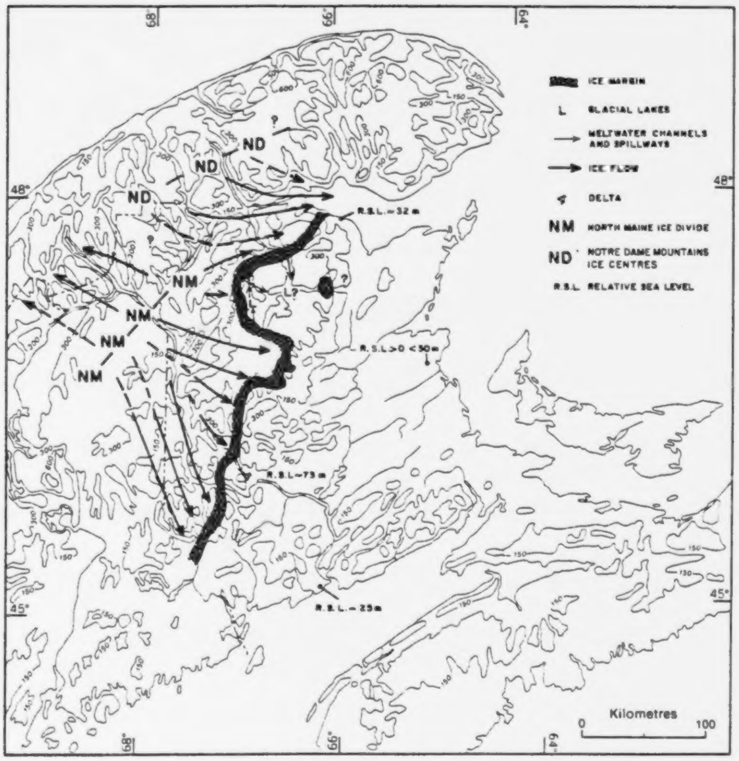

68°
66°
64°
48°
45°
ICE MARGIN
L GLACIAL LAKES
MELTWATER CHANNELS AND SPILLWAYS
ICE FLOW
DELTA
NM NORTH MAINE ICE DIVIDE
ND NOTRE DAME MOUNTAINS ICE CENTRES
R.S.L. RELATIVE SEA LEVEL
ND
ND
ND
NM
NM
NM
NM
L?
?
?
R.S.L.~32 m
R.S.L.>0 <50 m
R.S.L.~73 m
R.S.L.~25 m
Kilometres
0
100

Fig. 4.3 – Ice-flow directions during maximum extent of the Millville/Dugarvon phase (after Rampton et al., 1984).

The remaining Plaster Rock (~12.4 ka B.P.), Chaleur (12.4 ka B.P.), and Madawaska (12.2 ka B.P.) phases concern only northern New Brunswick and collectively mark the end of Late Wisconsinan glaciation in New Brunswick (Rampton et al., 1984).

4.2 Deglaciation of southwestern New Brunswick

Two lines of thought have evolved concerning the deglaciation of southwestern New Brunswick. Gadd (1973) reconstructed a pattern of ice retreat based on the orientation of major end moraines in the coastal region between St. George and Saint John as well as the orientation of minor inland moraines and glaciofluvial complexes. He postulated that deglaciation consisted of ice-marginal retreat towards the northwest with fluctuations in the rate of melting as the margin retreated. The problem with this model, as identified by Seaman et al. (1993), is that although a band of discontinuous kame moraine exists near the coast between St. George and Saint John such examples can not be found inland. These features would be expected in the event of a step-like retreat.

Seaman et al. (1993) proposed that deglaciation occurred by means of regional scale stagnation where ice essentially melted in place leaving isolated ice remnants occupying topographic lows. Upon re-examination of the "minor moraines" of Gadd (1973) in a follow-up study, Seaman et al. (1993) found them to be either ablation complexes or ribbed moraine sequences. In addition, S-shaped and donut-shaped ablation ridges, typical of remnant ice wasting, were also documented by Seaman et al. (1993).

Major ice-stagnation features characterize the Rollingdam area. The presence of an extensive and hummocky ablation blanket to the east of the Digdeguash River (Fig.

1.2b), as well as localized zones of ablation material occupying topographic depressions throughout the area, can be interpreted as evidence for a stagnant melt-out environment.

4.3 Summary

Glacial processes that occurred in southwestern New Brunswick are defined by a complex and dynamic system of landforms and striae that record the variable activity and interaction of local ice centres. The Laurentide Ice Sheet was likely blocked from entering southwestern New Brunswick during Wisconsinan glaciation by ice centres occupying the highlands of northern Maine and the Gaspe Peninsula. Instead, local ice masses acting either in unison or independent of each other produced the intricate erosional patterns and depositional sequences found in southwestern New Brunswick.

Although it has long been believed that Late Wisconsinan glacial activity in southwestern New Brunswick occurred as a series of distinct phases, due to variable activity of proposed ice centres, newer ideas are currently evolving. Local climatic variation over time and variable zones of ice accumulation are now being considered as new factors that may have contributed to the complexity of glaciation in southwestern New Brunswick (see Chapter 6, section 6.2). Similar models have recently been presented for the glaciation of British Columbia (Stumpf, 2001).

Deglaciation of southwestern New Brunswick likely occurred by means of rapid melting and stagnation of isolated ice masses. Irregularly shaped ablation ridges, the presence of sub-glacial melt-out till, and the absence of any inland end moraine systems indicate that a regional stagnation scenario existed across the study area.

CHAPTER 5

RESULTS AND INTERPRETATIONS

5.1 Till Characteristics

Found within the study area are three varieties of till. In order of their prominence they are (1) basal till; (2) ablation till; and (3) flow till. Basal till predominantly occurs as blankets or veneers, covering large expanses of land. Sections of at least three metres in thickness were noted in some areas, predominantly on the lee side of topographic highs (e.g., south of Basswood Ridge; Fig 1.2a), while veneers of only a few decimeters in thickness or less were often found to cover areas typical of bedrock exposure at the surface. Commonly, the thickness of the basal till unit ranges from 1m to 1.5m.

Ablation till is common throughout the study area, owing to regional-scale stagnation of local ice at the end of the Late Wisconsinan (~13 ka B.P.). This 'wasting' resulted in an irregular areal distribution of ablation till that includes both blankets/veneers in areas where remnant ice-masses may have existed as well as smaller isolated occurrences. Ablation till is presumably underlain by basal till but in some instances it is found deposited directly over bedrock. Deposit thickness varies significantly from tens of centimetres to approximately five metres at some locations, and the terrain surface of ablation deposits is either hummocky or characteristic of irregular shaped ridges with no preferred orientation.

Only one occurrence of flow till was documented in the study area near Fahey's Hill (Fig. 1.2a). Here a wedge of diamicton was encased between layers of ice-contact sediment, overlain by about two metres of sand and gravel and underlain by at least three metres of sand and gravel (Plate 5.1). The presence of flow till interbedded with glaciofluvial or ice-contact sediments is usually indicative of ice melting at the terminus of a glacier. The dominant sedimentary characteristics of the collected basal till and ablation till samples are described in the following sections.

5.1.1 Basal Till

A single basal till unit, comprised of a coupling of basal melt-out and lodgment till, resulting from a multidirectional depositional ice-flow sequence was encountered during fieldwork in the Rollingdam area. This concept will be further explained in Chapter 6, sections 6.1 and 6.2. Typically only one end-member was present at each sample location; however, some exposures displayed a gradation from basal melt-out till into lodgment till. Despite this, no attempt was made to sample one medium exclusively. Because both sub-groupings of basal till found throughout the study area are remarkably similar in terms of physical attributes, distinguishing between the two with consistency in the field from one sample site to another was considered a futile exercise. Both end-members are composed of the same fragmental rock material derived from the basal load of the ice mass and therefore belong to the same facies (subglacial melting-ice facies of Brodzikowski and Van Loon, 1987). They are geochemically and lithologically identical and differ only in the mechanics involved leading to their deposition.[1]

---

[1] According to Bennett and Glasser (1996), lodgment till is deposited during active glacial transport under warm-based conditions. Rock debris entrained within the glacier's basal load is subjected to a variety of forces. The ice imposes drag on the debris that acts to propel it forward but the debris does not necessarily travel at the same velocity as the ice. Friction between this rock debris and the substrate acts to reduce the velocity of the material. When the friction between the debris and substrate exceeds the drag imposed by the overlying ice, the debris is deposited or "lodged"; hence the term lodgement till. Basal melt-out till is deposited when the glacier is subject to basal melting conditions and material essentially melts out in place.

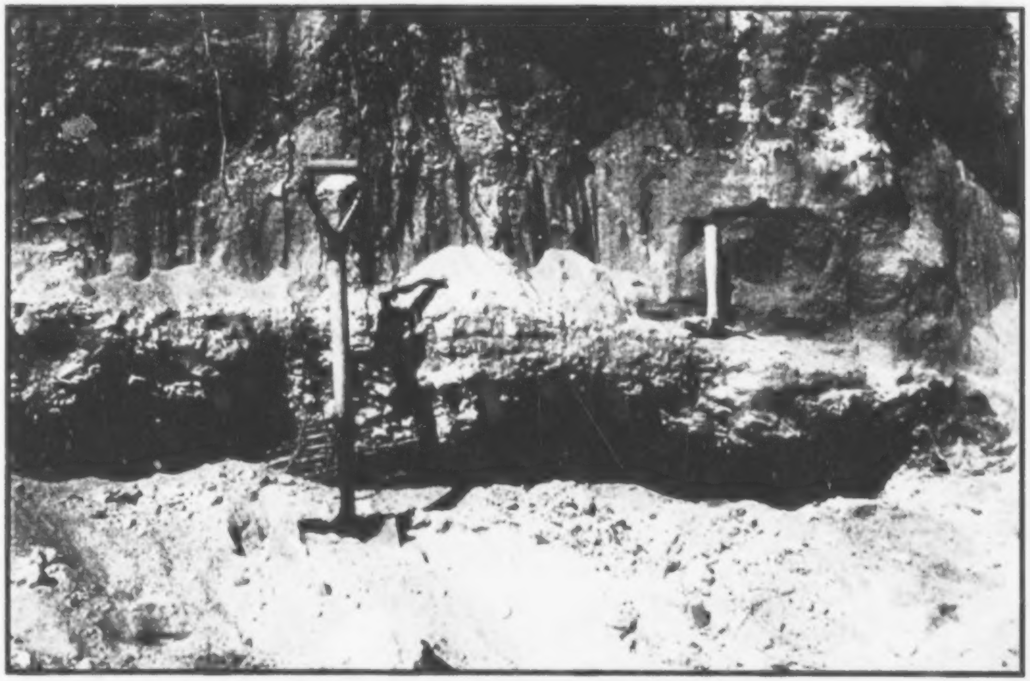


Plate 5.1 - Wedge of flow till embedded in a profile of ice-contact sediment found near Fahey's Hill in the southwestern corner of the study area (Fig. 1.2a).

Collected basal till samples are matrix-supported and characteristic of a bimodal particle size distribution. Clasts range from pebble-size to cobble-size and the matrix texture varies from a sandy-loam to a sandy-clay-loam (see Chapter 5, section 5.2 for results of granulometric analysis). In terms of compaction, samples range from very friable to very compact. This large range in compaction can be attributed to a number of factors including moisture content, the degree of groundwater influence, and the relative amount of fines (clay and fine silt) within the till. Basal till colour is quite consistent across the study area, characterized by yellowish brown shades that reflect the colour of local bedrock units. Over half of the study area is comprised of Flume Ridge Formation and Digdeguash Formation strata (Fig. 1.5) that are uniform in colour and therefore influence the colour of the till the most. Local variations in colour, however, are apparent in the northeastern and northwestern corners of the study area where Carboniferous aged Shin Formation rocks occur. In these areas, basal till is characterized by reddish brown hues that correspond to the distinctive maroon colour of the Shin Formation rocks.

5.1.2 Ablation Till

The ablation till of the Rollingdam study area is in some regards unique. Typically ablation tills are dominated by sediment characteristics associated with long distance transport with incorporated clast lithologies representative of distal sources (Bennett and Glasser, 1996). This is not the case here. Ablation tills found in the Rollingdam area, and throughout southwestern New Brunswick (Balzer, 1992; Balzer and Broster, 1994; Stumpf, 1995), are of local derivation, comparable to that of basal till in the area. The mechanics involved leading to this type of scenario are explained here.

It is likely that as the glacier approached its terminus a compressive flow regime developed due to intense ablation of the local ice and a marked decrease in velocity at the snout of the glacier. Up ice, basal creep would have continued, thereby establishing strong compressive forces within the ice mass. To compensate for this increased compression and decrease in the rate of basal ice flow, thrust planes would have developed in the ice mass.

Normally, these thrusts propagate from the base of the ice-mass up into the englacial zone, sometimes penetrating the glacier and often exploiting a structural weakness such as a former crevasse (Bennett and Glasser, 1996). As these thrust planes continue to spread into the ice, material, varying from debris-rich ice to rafts of frozen sediment, is sheared from the basal position into the englacial position. Once in the englacial zone, fragmental rock debris is not subject to the same degree of crushing and pulverization characteristic of material entrained at the base of the glacier (Dreimanis, 1976). With continued compression and the development of well-defined thrust planes within the ice mass, large amounts of debris were likely sheared into the englacial zone and upon melting; were subsequently deposited as ablation till. Unlike deep-valley glaciers or glaciers traversing mountainous terrain, the ice-mass travelling across southwestern New Brunswick would have been comparatively devoid of supraglacial debris due to the lack of sources (topography). The result is ablation till of local origin dominated by material released from the englacial zone (englacial melt-out till of Brodzikowski and Van Loon, 1987).

Collected ablation till samples are matrix-supported and have a bimodal particle size distribution, although unimodal ablation tills were encountered in the field. Like basal till, clasts range from pebble- to cobble-size but the matrix texture is substantially coarser, varying from a loamy-sand to a sandy-loam (see Chapter 5, section 5.2 for results of granulometric analysis). The relative coarseness and loose particle packing characteristic of ablation till in the area can be attributed two factors. Because the material was transported in the englacial position and, to a lesser extent, the supraglacial position, it was not subject to intense pulverization and grinding and therefore may not have been broken down to the same extent as basal till. Also, since the ablation till was deposited during a stagnation event, it was likely subject to some degree of winnowing of fines (clay and fine-grained silt) by meltwater activity. In terms of colour, it is similar to that of basal till.

5.2 Granulometric Analysis

Granulometric analysis was performed on the <2mm fraction of all collected tills (Appendix 2). Percentages of sand, silt, and clay within the till samples were determined using a modified hydrometer method (Appendix 2) and the results contoured and posted using the Surfer 6.01® contouring package.

Mean percentages of sand, silt, and clay among samples of basal till were calculated as 53.3%, 35.9% and 10.9% respectively. As expected (Dreimanis, 1976), ablation till samples were elevated in sand concentration and diminished in silt and clay. Average percent sand among ablation till samples amounted to 64.1% while silt and clay content averaged 30.9% and 5.1% respectively.

Overall, the areal distribution of these granulometric parameters throughout the study area till is irregular and nearly homogeneous with only limited evidence of any emergent trends. Any heterogeneity in the contour plots (e.g., Fig. 5.2) seems to be controlled by two factors: (1) the presence of ablation till and (2) the variability in texture among bedrock units across the study area. Ablation till samples are substantially coarser than those of basal till; therefore, there is a tendency for ablation till distributions to appear as elevated zones of sand concentration and diminished zones of silt/clay. Also, because the study area till is presumed to be of local derivation, local bedrock units affect the texture of the till. Zones of slightly coarser till are likely produced from the ice mass overriding coarse-grained rock units, while zones of finer-grained till are likely derived from the glacier overriding fine-grained rocks.

Although the primary use of the granulometric data was for quantifying textural characteristics of the collected till samples (Appendix 5), the data were also used to assess variations in grain size distribution that could affect the reliability of the geochemical data. Geochemical analyses were performed on the silt plus clay (<0.063 mm) fraction of the till samples. Because of the potential for element partitioning within this size distribution, due to variations in terminal grade among minerals and native elements, it had to be demonstrated that the silt/clay ratios remained within an acceptable range among all samples. If these ratios were found to vary significantly from sample to sample there could exist biases on the geochemical data.

Found within the clay-sized fraction are the important metal-scavenging mineral phases, primarily phyllosilicates but also secondary weathering by-products such as iron and manganese hydroxides (Shilts, 1976). During weathering and comminution of rock debris in the glacial load, metal ions tend to become concentrated in the clay-sized fraction (DiLabio, 1988; Coker and DiLabio, 1989). Clay minerals have a high surface area to volume ratio and high cation exchange capacity; therefore, they can accommodate a wide range of atomic radii (Shilts, 1995). Alternatively, the silt fraction (0.002 mm to 0.063 mm) is comparatively geochemically inert as it typically consists of over 90%

quartz and feldspar. Thereby, the silt acts to dilute the scavenging mineral phases within the volume of material to be analyzed. If the silt/clay ratios are consistent among samples, the dilution factor is constant from sample to sample and the geochemical data is inferred to be unbiased. This is the case herein. The mean silt/clay ratio within till collected throughout the Rollingdam study area is 5.6 with a standard deviation factor of ±5.2 (Appendix 2). This is deemed acceptable here, based on the following discussion.

Studies by Pronk (1987) have shown that for the purpose of identifying geochemical anomalies at the regional scale in New Brunswick, there is no significant difference in the results obtained from analyzing the clay plus silt fraction compared to the clay fraction alone. However, Pronk (1987) reported that background/anomaly contrast is somewhat higher in the clay fraction.

There are advantages in including the silt fraction in the volume of material to be analyzed. Although silt is composed of approximately 90% quartz and feldspar, some of the more resistant minerals such as cassiterite, rutile, and ilmenite, and some native elements such as gold and silver are typically found as silt-sized particles. Also, it is much more cost effective to analyze the silt plus clay fraction compared to the clay fraction. Separating the silt plus clay (<0.063 mm) from a till sample is relatively straightforward and can be accomplished using dry sieving techniques. Separating the clay fraction is much more complex and time consuming.

5.2.1 Sand

Sand is the dominant matrix component among collected till samples; occurring at a frequency approximately 1.5 times that of silt and almost six times that of clay. This dominance is due to the fact that the till is largely derived from medium-grained

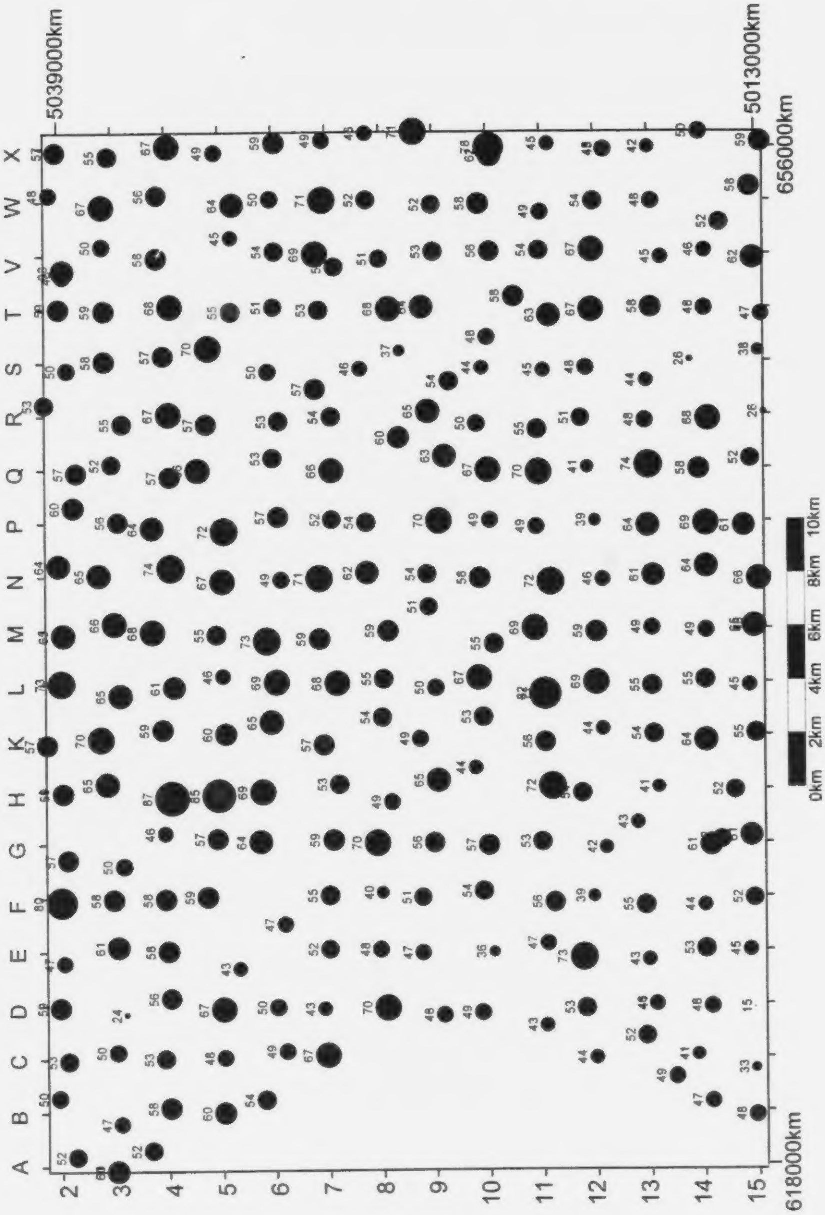

5039000km
5013000km
618000km
656000km
A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0km
2km
4km
6km
8km
10km

Fig. 5.1 - Percent sand in till (classed post).

sedimentary rocks which underlie most of the study area (Fig. 1.5). Sand concentration within till is characteristic of a nearly homogenous distribution (Fig. 5.1). Because of the difficulty associated with identifying trends in the classed post plot (Fig. 5.1), a contour plot showing only high sand concentrations (>60%) was produced (Fig. 5.2). Evident in the contour plot are localized areas characteristic of elevated values and maximum concentration can clearly be discerned in the central portion of the study area towards the north (Fig. 5.2) where ablation till samples were collected at a greater frequency.

5.2.2 Silt

As expected, the areal distribution of silt, like sand, is characteristic of a near homogeneous distribution with only moderate variability throughout the study area although unsystematic. Figure 5.3 demonstrates this variability in terms of a classed post plot while Figure 5.4, a contour plot, shows only elevated values (>36%). The areal distribution of silt seems to be indifferent to the location of ablation till sites in that anomalous values are spread throughout the study area without any demonstrable trend (Fig. 5.4).

5.2.3 Clay

The overall areal distribution of clay is sporadic and typical of modest variation throughout the study area, as evident in the classed post plot (Fig. 5.5) and contour plot (Fig. 5.6). However, maximum clay concentrations are found in areas of low elevation, notably along the southern margin of the study area (Fig. 5.6). Although a fairly weak pattern, this can be construed as potential evidence for a southward increase in clay content.

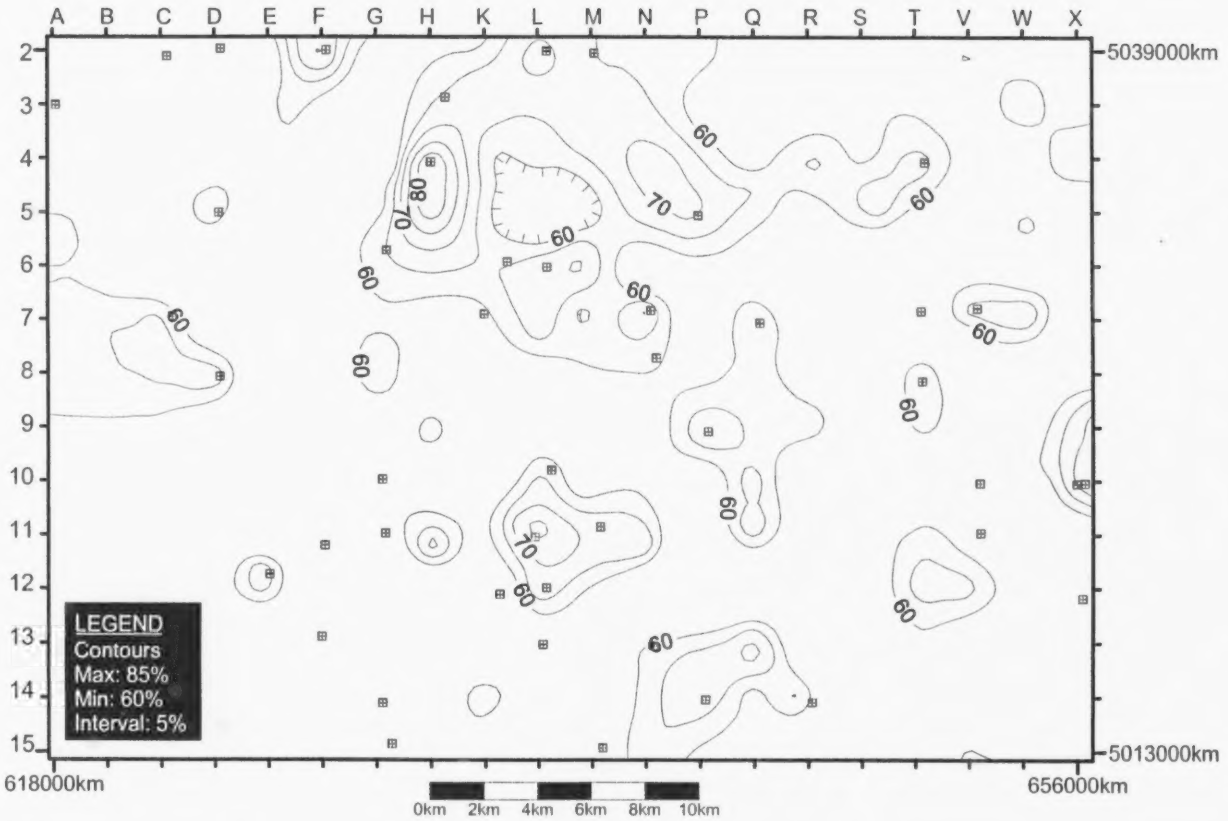

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000km
5013000km
618000km
656000km
60
70
80
0km 2km 4km 6km 8km 10km
LEGEND
Contours
Max: 85%
Min: 60%
Interval: 5%

Fig.5.2 - Percent sand in the till matrix.
⊞ Ablation till sample site locations.

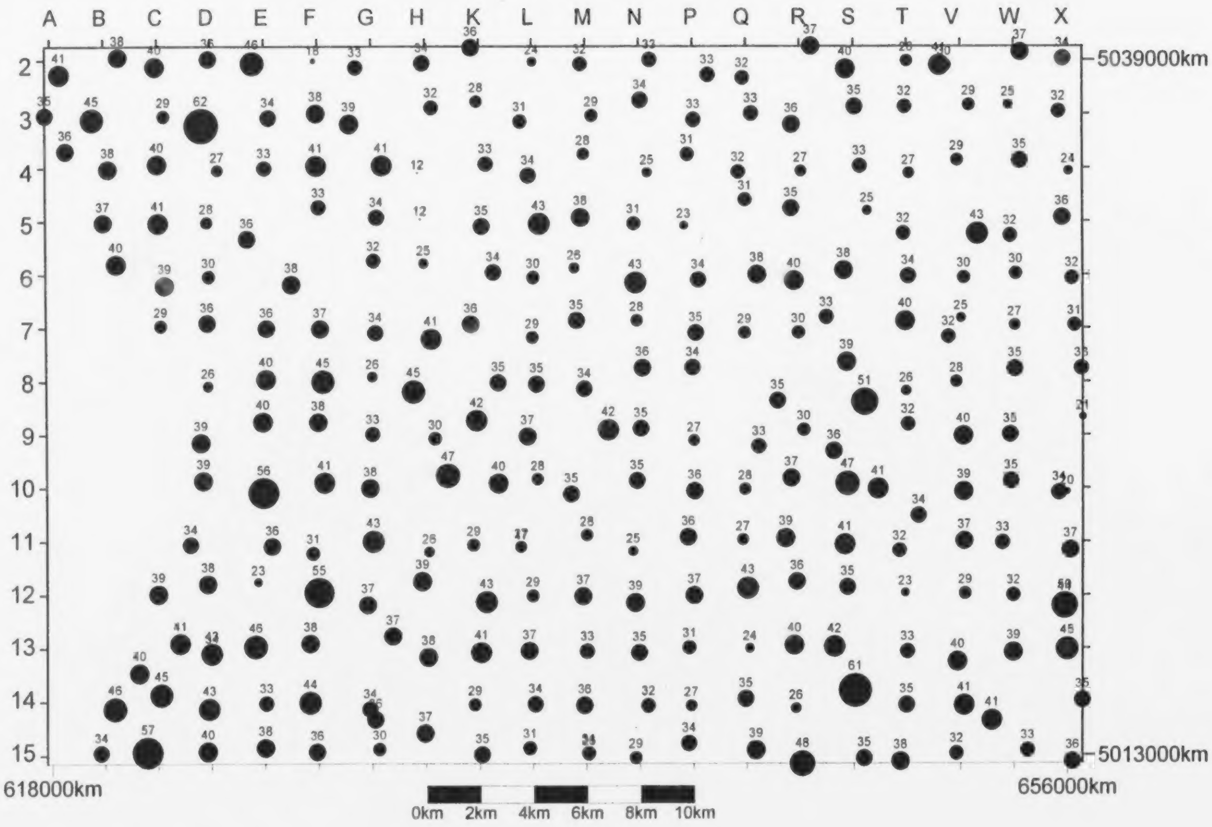

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000km
5013000km
618000km
656000km
0km 2km 4km 6km 8km 10km

Fig. 5.3 - Percent silt in till (classed post).

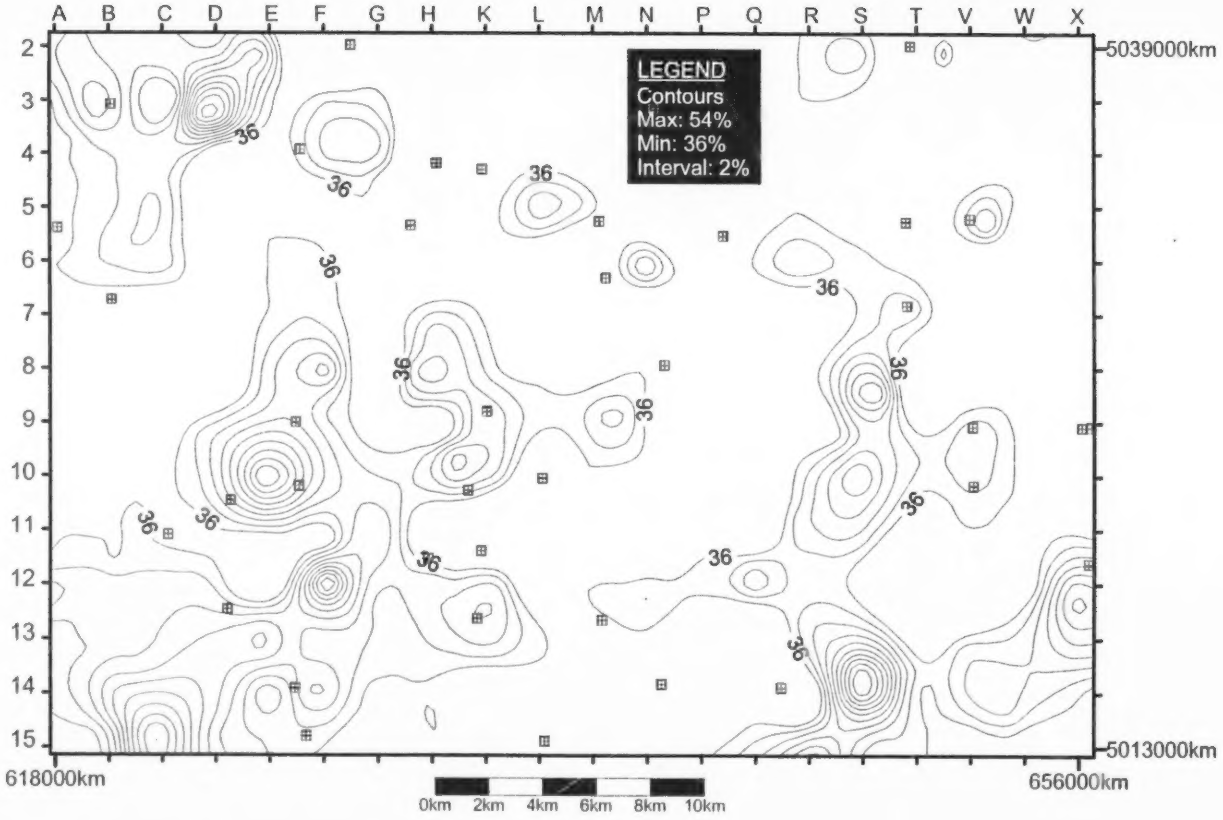

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000km
5013000km
618000km
656000km
LEGEND
Contours
Max: 54%
Min: 36%
Interval: 2%
36
0km
2km
4km
6km
8km
10km

Fig. 5.4 - Percent silt in the till matrix.
⊞ Ablation till sample site locations.

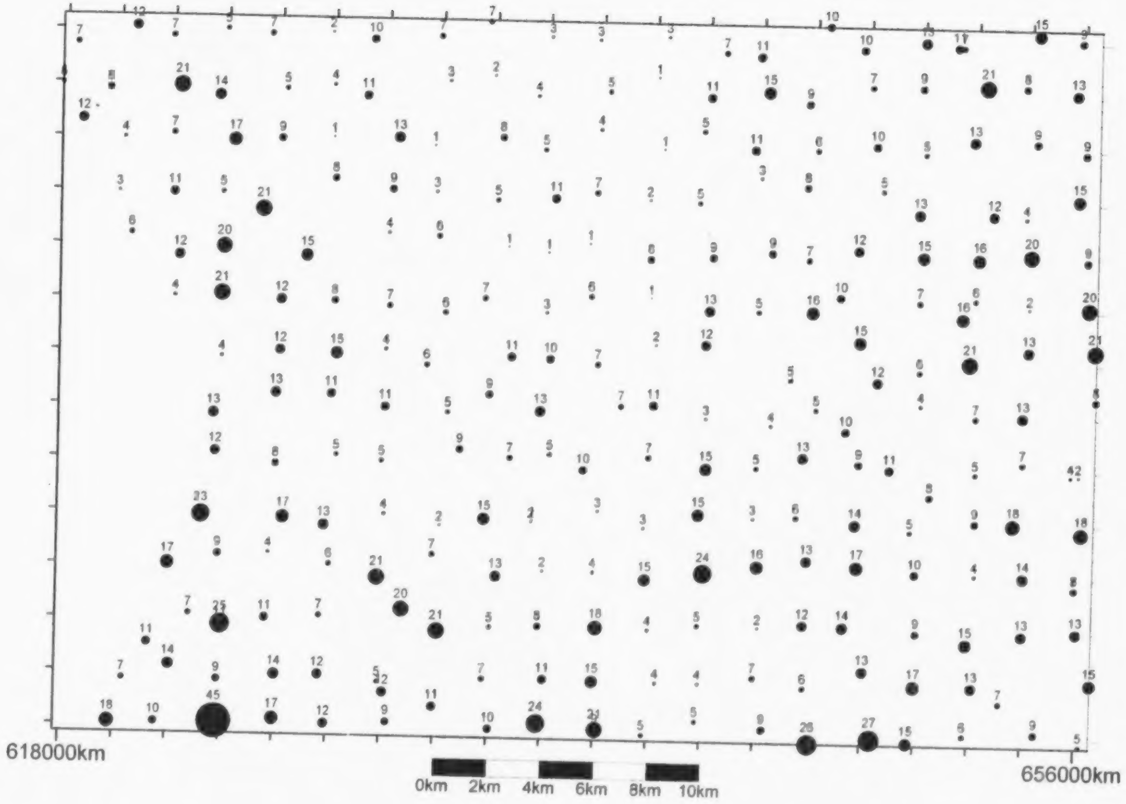

618000km
656000km
0km
2km
4km
6km
8km
10km

Fig. 5.5 - Percent clay in till (classed post).

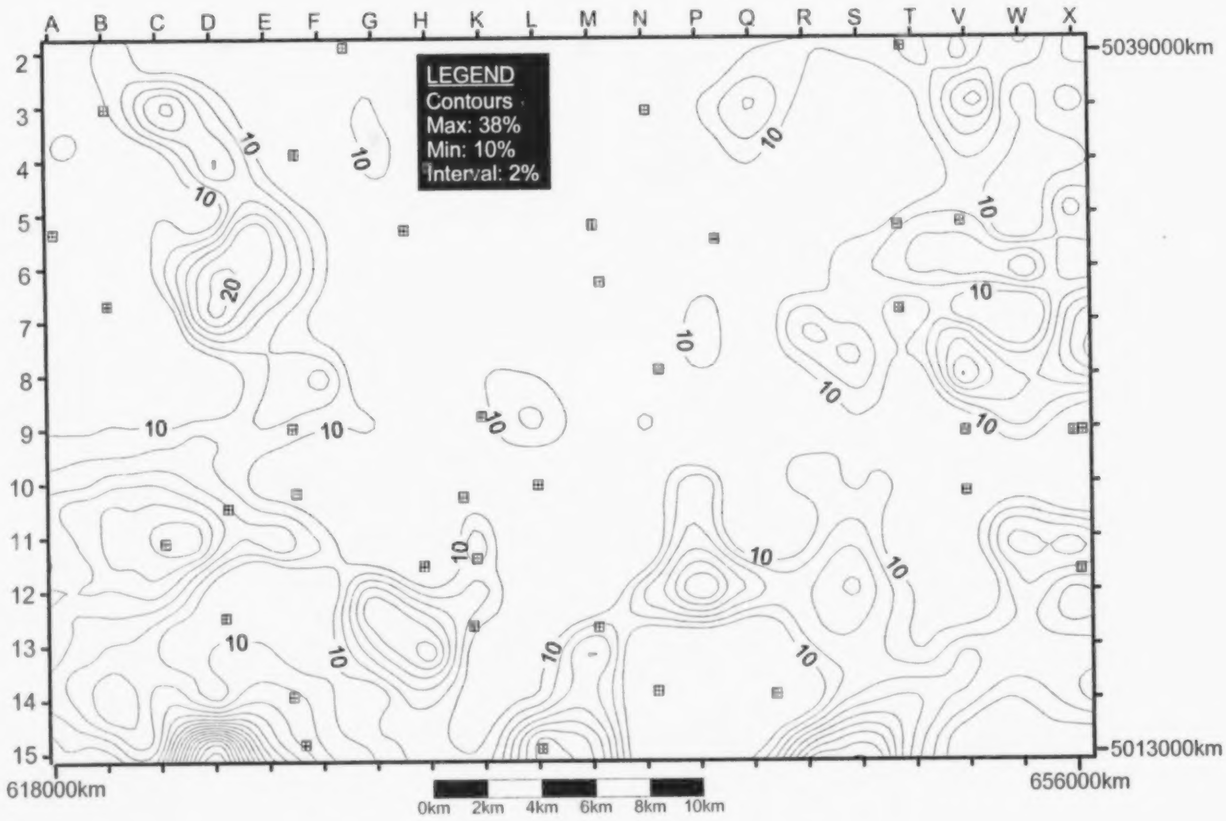

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000km
5013000km
618000km
656000km
LEGEND
Contours
Max: 38%
Min: 10%
Interval: 2%
10
20
0km
2km
4km
6km
8km
10km

Fig. 5.6 - Percent clay in the till matrix.
▪ Ablation till sample site locations.

5.3 Lithological Analysis

Examination of the clast component of till is an important aspect of a till survey in that it provides a useful tool for delineating dominant ice-flow directions responsible for its deposition. Glaciers disperse material in the form of a negative exponential curve with peak concentration occurring at the source (head) or just down ice from the source. Following this peak is a sharp decline in concentration producing a "tail" which is elongated in the down-ice direction. This declining concentration is referred to as a dispersal train. By examining the areal distribution of various pebble lithologies in till for patterns of dispersal from corresponding bedrock sources, the dominant depositional transport path across the study area can be delineated.

Pebbles collected at the 272 sample sites were first examined in hand specimen. Over twenty distinct till clast lithologies were identified across the area, and for each sample site the percent concentration of each lithology present was determined (refer to Appendix 3 for a summary of lithological data). The lithological data (percents) for specific lithologies and combined groupings of related lithologies indicative of local bedrock units were then contoured using the SURFER 6.01® contouring program. Chapter 3 describes the methodology used. Only contour plots demonstrating significant dispersal trends are discussed in this section.

5.3.1 Clastic Sedimentary Lithologies

Before lithological analyses were conducted, it was theorized that the Carboniferous Shin Formation (Fig. 1.5) would be the best indicator unit in the study area from which dispersal trends could be quantified. This is because of (1) its limited occurrence in the study area, as it occurs only in the northwestern and northeastern corners of the study area and; (2) the fact that the Shin Formation is the only source of maroon-coloured sedimentary rocks within the study area and therefore clasts could easily be identified on the basis of colour.

Clasts derived from the Shin Formation polymictic pebble conglomerate, ranging from dark greenish-grey to maroon, are found in peak concentration near their source areas in the northeastern and northwestern corners of the study area. Peak clast concentration of maroon arkosic sandstone and siltstone, which are found interbedded with the Shin Formation conglomerate (Fyffe, 1997), also occur in these source areas. Because grey conglomerate is a minor constituent of both the Oak Bay Formation and Digdeguash Formation (Fyffe, 1997), interpretation of dispersal from the Shin Formation unit was limited to the examination of its maroon coloured components. Evident in the contour plots involving maroon clasts are dispersal trains ranging from 6 km to 36 km in length. Maroon sandstone clasts (Fig. 5.7) define a 6 km long dispersal train trending east-southeast (~110°) in the northwestern corner of the study area, as well as a southeasterly (~135°) trending dispersal train in the northeastern corner of at least 10 km in length. Maroon siltstone clasts also define a small southeasterly (~140°) trending dispersal train in the northwestern corner of the study area (Fig. 5.8).

Maximum dispersal within the study area is well defined by the red conglomerate clast plot (Fig. 5.9). Dispersal is towards the southeast (~130°-135°) emanating from

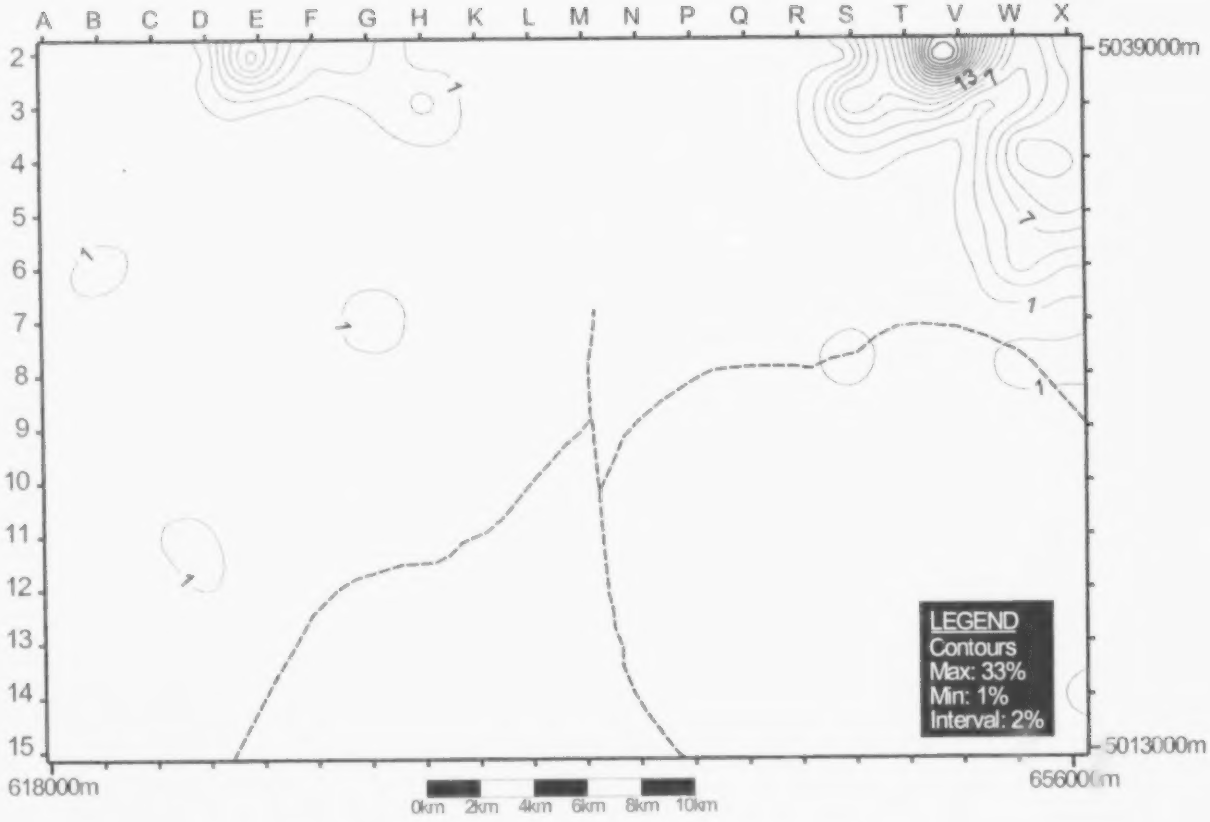

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
1
13
LEGEND
Contours
Max: 33%
Min: 1%
Interval: 2%
0km 2km 4km 6km 8km 10km

Fig. 5.7 - Maroon sandstone clast dispersal in till.

☐ Probable clast source area.

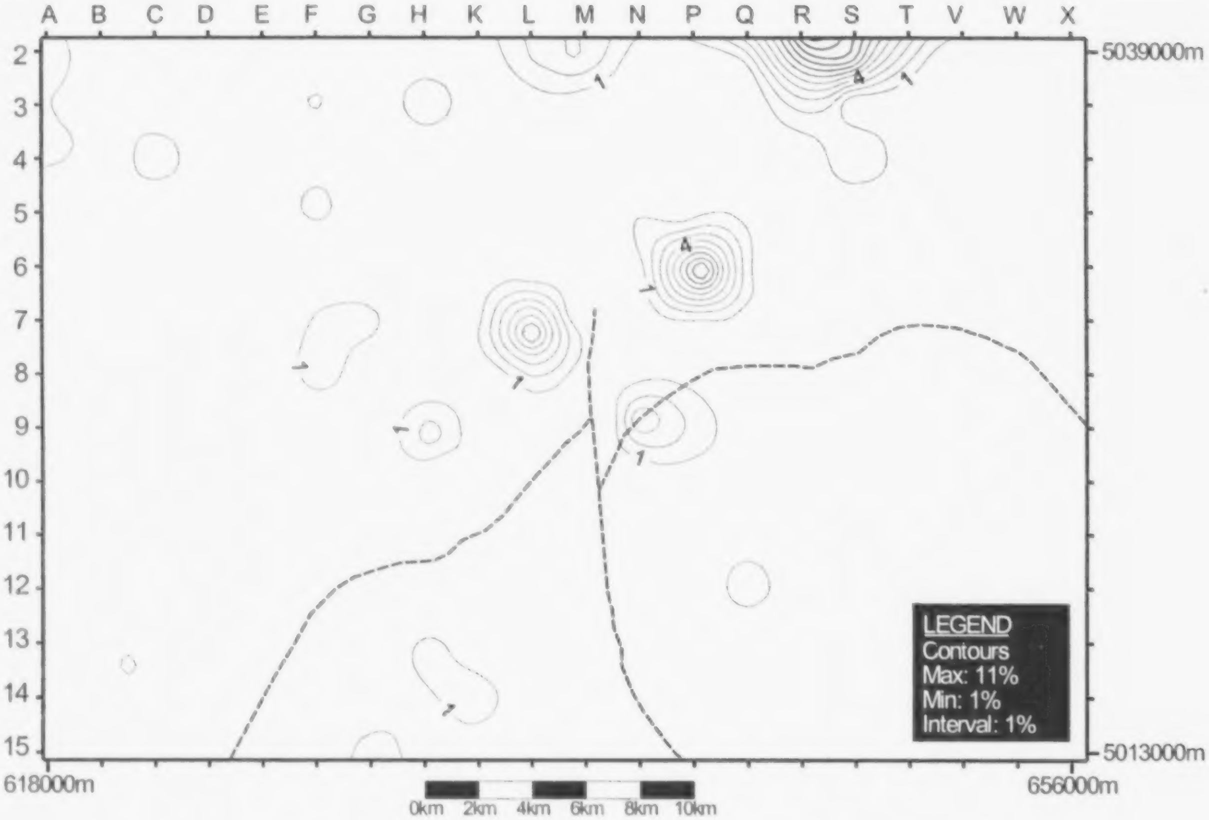

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
1
4
LEGEND
Contours
Max: 11%
Min: 1%
Interval: 1%
0km 2km 4km 6km 8km 10km

Fig. 5.8 - Maroon silttone clast dispersal in till.

☐ Probable clast source area.

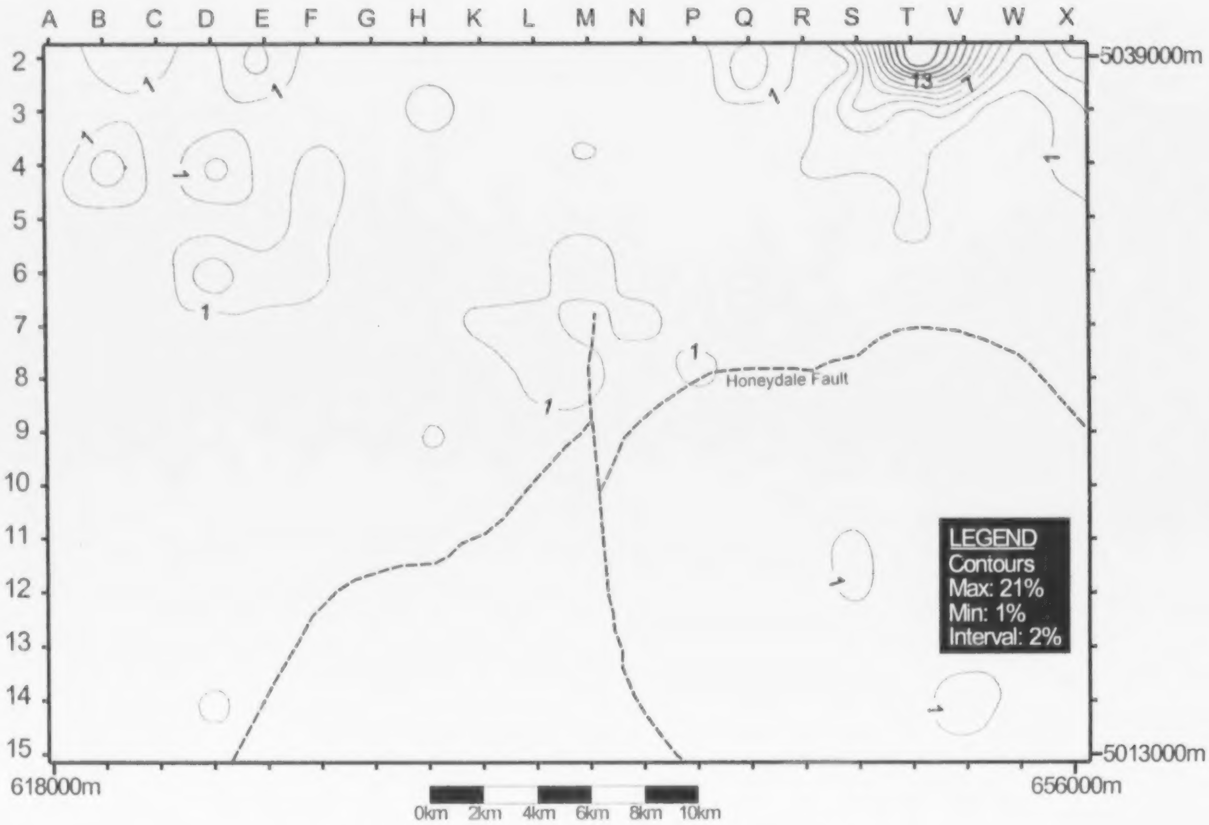
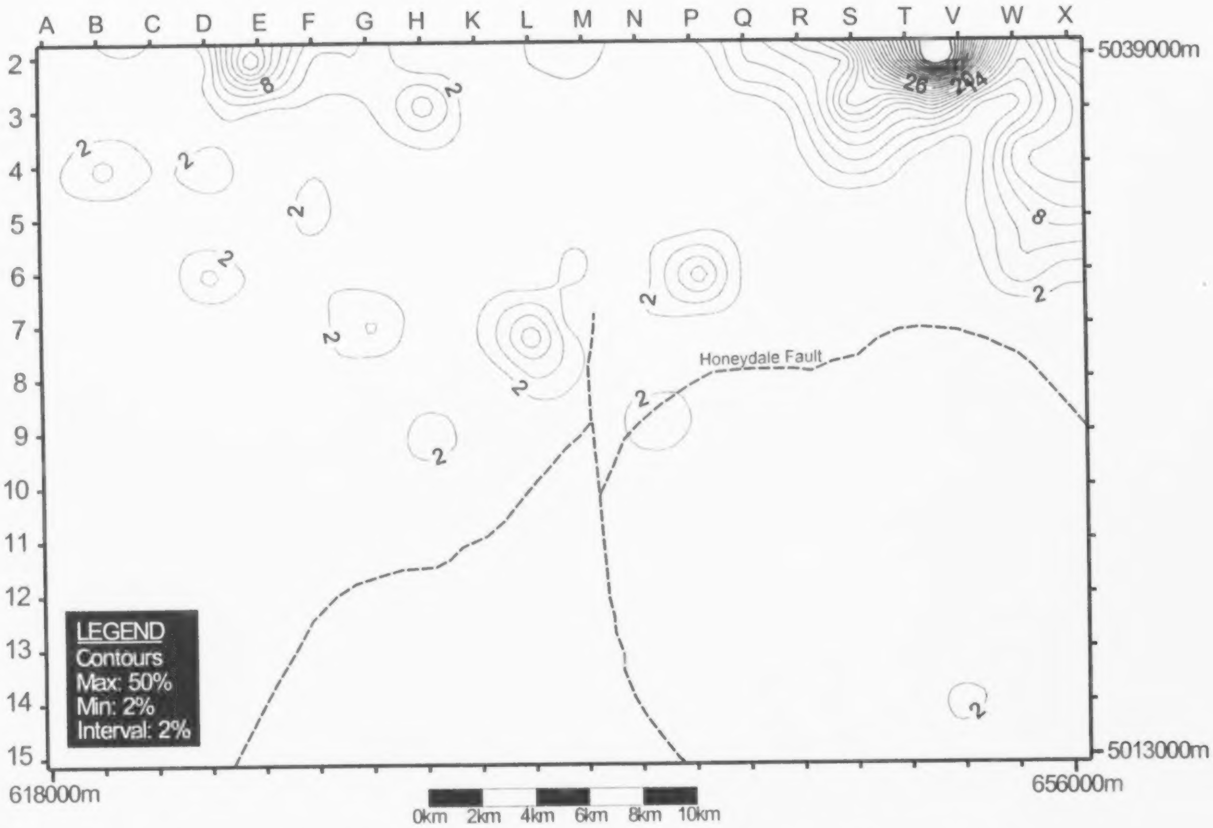

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
1
13
Honeydale Fault
LEGEND
Contours
Max: 21%
Min: 1%
Interval: 2%
0km 2km 4km 6km 8km 10km

Fig. 5.9 - Maroon conglomerate clast dispersal in till.

☐ Probable clast source area.



A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
0km 2km 4km 6km 8km 10km
LEGEND
Contours
Max: 50%
Min: 2%
Interval: 2%
Honeydale Fault
2
8
26

Fig. 5.10 - Combined maroon sedimentary clast dispersal in till.

☐ Probable clast source area.

Shin Formation rocks in the northwestern corner of the map area and reaching the southeastern corner (Fig. 5.9), approximately 36 km distant. The combined maroon sediment clast plot (Fig. 5.10), which represents total dispersal from the Shin Formation again shows this southeasterly trending dispersal train. Also evident in this plot is southeasterly dispersal from the northeastern occurrence of Shin Formation rocks, confirming that dispersal is in fact towards the southeast (~135°).

5.3.2 Intrusive Lithologies

The areal distribution of intrusive lithologies throughout the study area as till clasts, is irregular and nearly homogenous apart from peak concentrations surrounding local sources (Fig. 5.11). Mean granitic clast concentration per site is 7%, a relatively high value considering that sedimentary clasts have a mean concentration of 84%. Gabbroic clasts occur at a lower consistency with an average concentration of 2%.

Peak concentrations of granitic clasts are found in tills overlying and just south of the Tower Hill Granite as well as the area encompassing the Sorrel Ridge Granite and Magaguadavic Granite (Fig. 5.12). Interpretation of dispersal from these sources is limited because of the proximity to the margins of the study area. However, it is evident that there is some southerly or southeasterly trending dispersal from the Tower Hill Granite but no information regarding the length or exact orientation of this dispersal train can be deduced.

A small (~6km long) southerly trending dispersal train of granitic clasts is discernible in the northeastern corner of the study area (Fig. 5.12). It is likely that this dispersal feature is part of a much larger dispersal train originating from the Pokiok Granite Batholith, located approximately 10 km north of the study area. The Pokiok

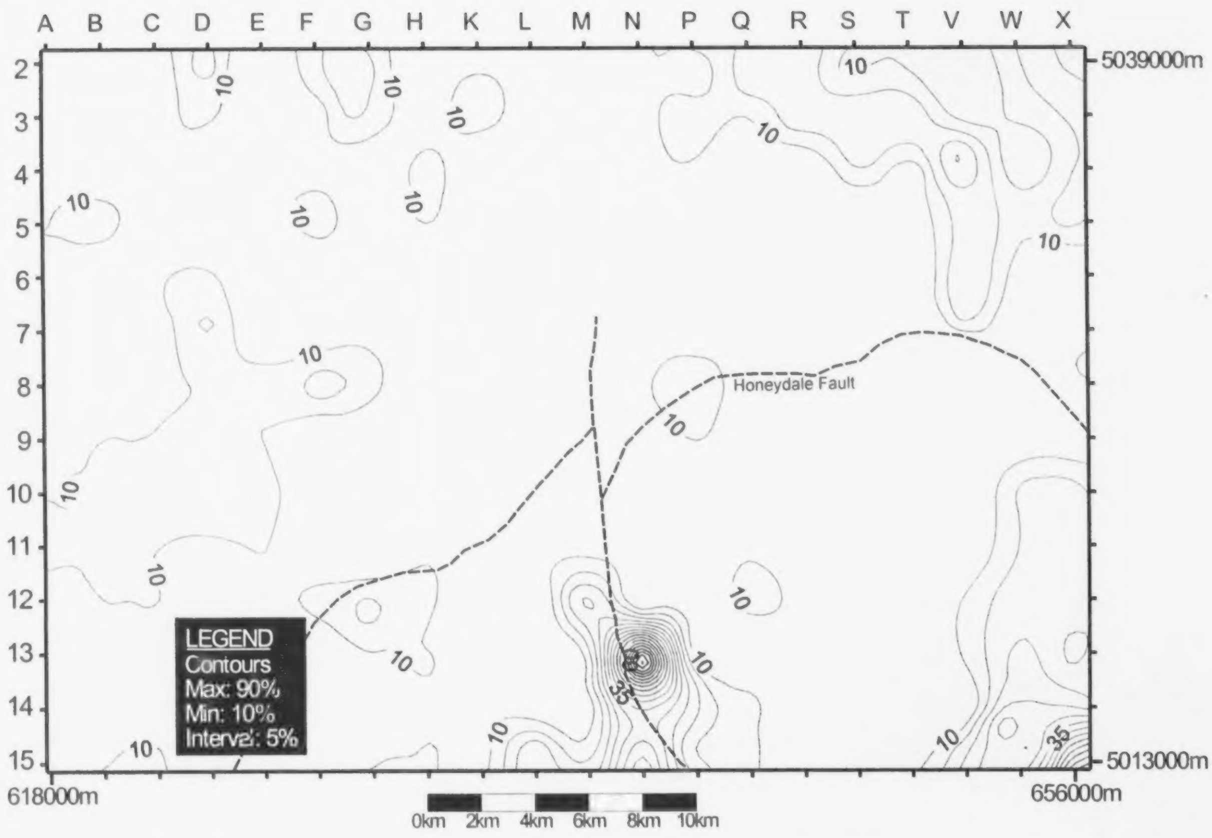

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
10
35
Honeydale Fault
LEGEND
Contours
Max: 90%
Min: 10%
Interval: 5%
0km
2km
4km
6km
8km
10km

Fig. 5.11 - Combined intrusive clast dispersal in till.

□ Probable clast source area.

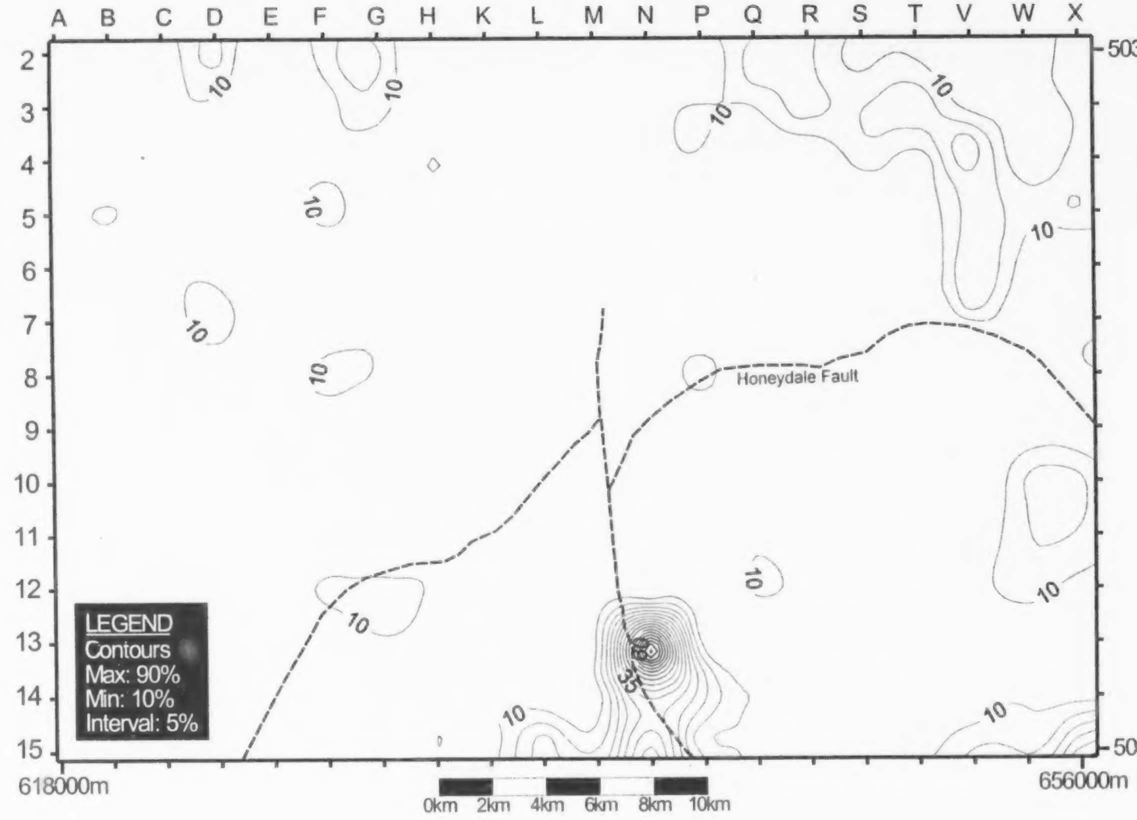

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
Honeydale Fault
10
35
80
LEGEND
Contours
Max: 90%
Min: 10%
Interval: 5%
0km
2km
4km
6km
8km
10km

Fig. 5.12 - Granitic clast dispersal in till.

□ Probable clast source area.

Granite is likely also the main source of distal granitic clasts found in tills at a somewhat consistent frequency throughout the study area. Another possible source of these granitic clasts is the Shin Formation, where clasts of granite have been found to exist within the conglomerate; however it is more likely that most granitic clasts are derived from the Pokiok Granite. Plate 5.2 shows granite boulders derived from the Pokiok Granite. These are commonly found on the surface throughout the study area.

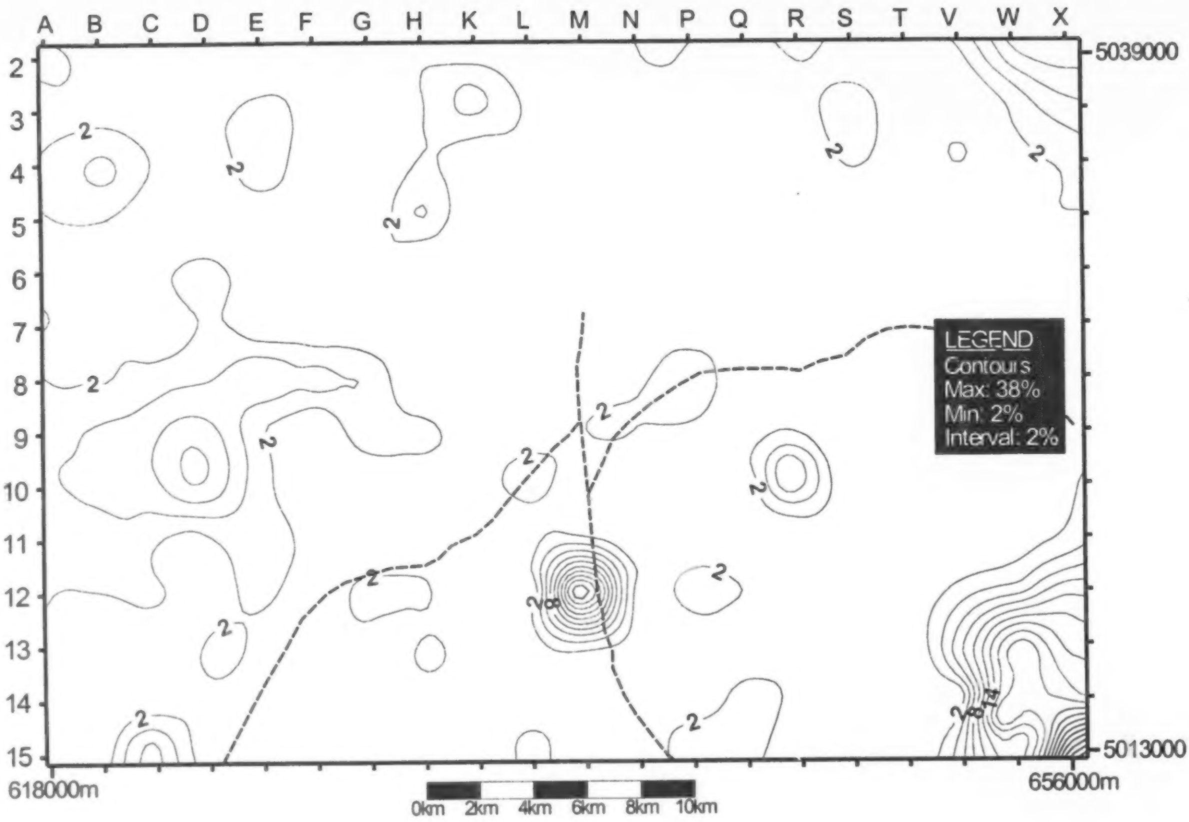
Gabbroic till clasts show an irregular areal distribution with no emergent patterns (Fig. 5.13). Peak concentrations are restricted to local sources, namely the Foster Lake Gabbro, located just south of the centre of the study area, and the Bocabec Gabbro located in the southeastern corner of the study area (Fig. 5.13). Mean gabbroic concentration per sample is nearly 2% and predominantly of distal origin, with the exception of sites near the above named local sources.

5.3.3 Extrusive Lithologies

Throughout much of the study area mafic and felsic volcanic clasts occur in till at background levels with mean concentrations on the order of 1% and 3% respectively. Areal distribution is irregular by nature with very few distinguishable dispersal features, owing to the lack of bedrock sources in the study area. A moderate portion of the extrusive till clasts are likely of distal origin, potentially having been transported large distances due to their inherent resistive properties. Maximum concentrations, however, are limited to local occurrences in the southeast.

Peak felsic volcanic till clast concentration (40%) is found in close association with the Waweig Formation rhyolites and tuffaceous sandstones, located in the far southeastern corner of the study area (Fig. 5.14). At this location a small 5 km long

Plate 5.2 - Granite boulders in the study area derived from the Pokiok Granite, which is located approximately 10 km north of the study area. These are found on the surface at a consistent frequency across the map area.



A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000
5013000
618000m
656000m
LEGEND
Contours
Max: 38%
Min: 2%
Interval: 2%
2
8
14
0km
2km
4km
6km
8km
10km

Fig. 5.13 - Gabbroic clast dispersal in till.

☐ Probable clast source area.

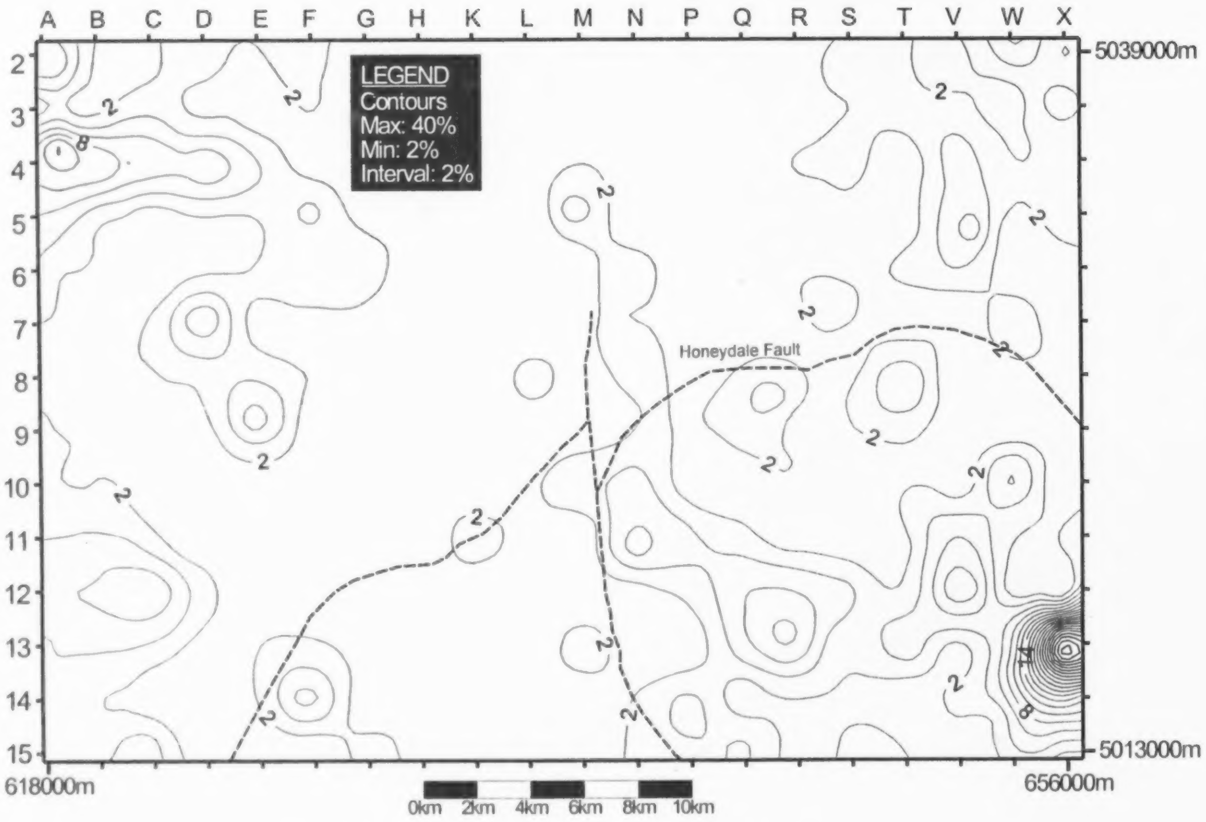

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
LEGEND
Contours
Max: 40%
Min: 2%
Interval: 2%
Honeydale Fault
5039000m
5013000m
618000m
656000m
0km 2km 4km 6km 8km 10km
2
8
14

Fig. 5.14 - Felsic volcanic clast dispersal in till.

☐ Probable clast source area.

dispersal train trending south-southwest (~200°) can be discerned. Anomalous felsic volcanic concentrations also occur in the northwestern corner in spatial association with the Shin Formation conglomerate (Fig. 5.14).

Maximum mafic till clast concentration (11%) also occurs in spatial association with the Waweig Formation and Calais Formation rocks to the southeast, an area characterized by localized mafic flows. Small southeasterly trending (~130°) dispersal trains of mafic volcanic clasts are distinguishable in the northeastern and northwestern corners of the study area, and likely emanate from the Shin Formation conglomerate occurrences (Fig 5.15).

5.4 Geochemical Analyses

Geochemical analysis for concentrations of 49 elements was conducted on the silt plus clay (<0.063 mm) fraction of all 272 collected till samples and the results contoured using the SURFER 6.01® contouring program. For a complete description of the methodology involved in sample preparation, analytical techniques used, as well as contouring methods refer to Chapter 3. Tabulated geochemical results, detection limits, and the results obtained from standard analyses are presented in Appendix 4. Only elements demonstrating significant and/or relevant dispersal patterns are discussed in this section while contour plots of other selected elements are presented at the end of Appendix 4. Refer to Appendix 5 for complete statistical analysis of the geochemical data per element.

Delineating geochemical dispersal patterns requires a comprehensive understanding of the driving forces at work. It is likely that most geochemical dispersal trains occurring in the study area are the combined result of syngenetic dispersal and

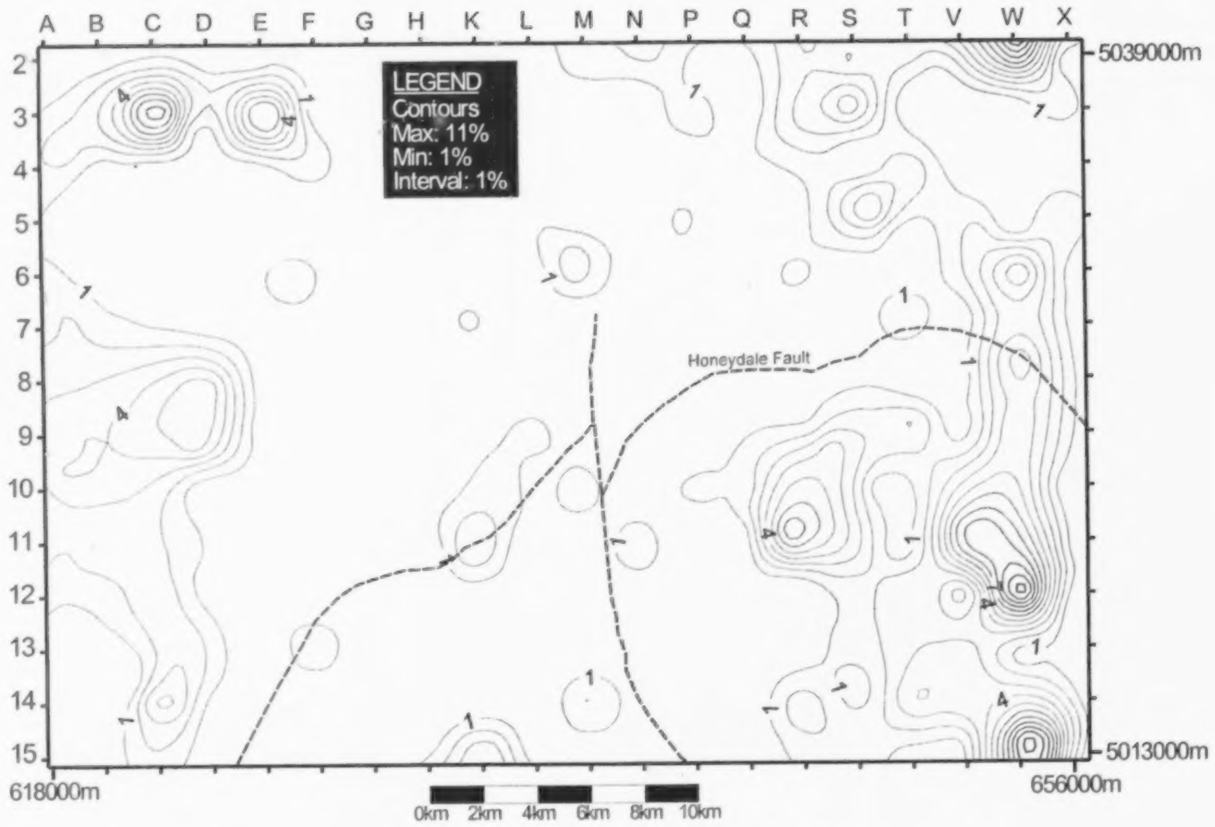

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
LEGEND
Contours
Max: 11%
Min: 1%
Interval: 1%
Honeydale Fault
1
4
0km 2km 4km 6km 8km 10km

Fig. 5.15 - Mafic volcanic clast dispersal in till.

☐ Probable clast source area.

some degree of epigenetic dispersal. Syngenetic dispersal refers to mechanical displacement of solid particles (Hawkes and Webb, 1962) and is not in any way controlled by the relative mobility of the elements. In the case of glacial dispersal, ice is the driving force that displaces debris thereby producing elongated dispersal trains parallel to the direction of ice flow.

Syngenetic dispersal trains in till are often complicated by some degree of redistribution and reworking of metal ions within the fine fraction by the action of groundwater subsequent to deposition. Secondary dispersal is referred to as epigenetic dispersal, and in the case of groundwater as the impelling force the term hydromorphic dispersal is used. There is a wide range of susceptibilities to hydromorphic dispersal among the elements and the potential for redistribution is referred to as mobility. For example, an element characterized by high mobility is subject to substantial hydromorphic redistribution while an immobile element is not.

An anomaly showing distinct dispersal in one direction coupled with evidence of prior or subsequent dispersal in another direction, regardless of the driving forces involved, is known as a palimpsest anomaly set. When a palimpsest anomaly is the result of multiple syngenetic dispersal events (ice-flow events) a chronology of events can be established by examining the resulting dispersal pattern (Parent et al., 1996). Caution must be exercised when interpreting palimpsest anomalies in that local scale redistributions are more likely to be of epigenetic rather than syngenetic origin.

Hawkes and Webb (1962) state that successful interpretation of geochemical data obtained from glaciated terrain is not possible without some means of distinguishing syngenetic dispersal patterns from epigenetic dispersal patterns. Distinguishing criteria used in this study were: (1) the relative susceptibility of the elements to hydromorphic redistribution (mobility of the elements), and (2) the assumption that depositional ice-flow paths in the geochemical medium will parallel the syngenetic dispersal trends identified in the clast medium. To aid the reader in locating discussed anomalies the coordinates of the head of the dispersal train are provided along with the corresponding contour plot (e.g., coordinates G-4; Fig. 5.16).

5.4.1 Lithophile Elements

The lithophile elements as a group are typical of "bullseye"-shaped anomalies with a short tail slightly elongated in one direction, and irregular distributions showing no preferred alignment, possibly reflecting some redistribution from hydromorphic processes. Strontium is characterized as being moderately mobile while chromium immobile (Hawkes and Webb, 1962), and of the 21 lithophile elements analyzed, these show the strongest dispersal elongations parallel to clast trains and corresponding striae orientations.

Strontium. Of all elements analyzed, strontium exhibits the longest single dispersal train. It appears as an approximately 12 km long ribbon-shaped anomaly trending towards the southeast (~140°) and demonstrates potential secondary dispersal towards the east-northeast for a distance of 4-6 km (coordinates G-4; Fig. 5.16). Other strontium anomalies typical of this palimpsest configuration are evident throughout the study area (coordinates H-10, R-7; Fig. 5.16) and it is possible that the redistribution towards the east is the result of hydromorphic dispersal or some other form of epigenetic dispersal. The prevailing southeasterly trend (~140°) of the anomalies is interpreted as syngenetic in that the orientation is concurrent with the dominant clast dispersal trend.

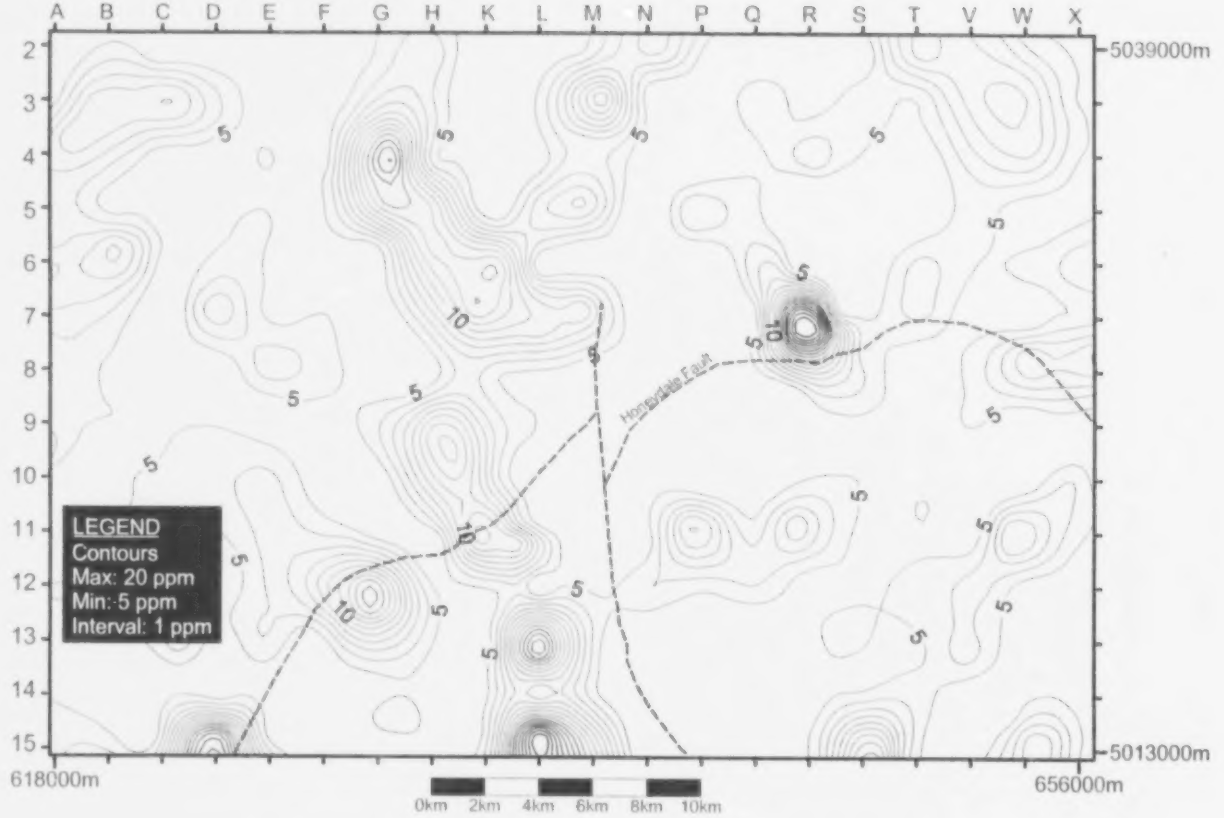

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
Honeydale Fault
LEGEND
Contours
Max: 20 ppm
Min: 5 ppm
Interval: 1 ppm
0km
2km
4km
6km
8km
10km
5
10

Fig.5.16 - Strontium dispersal in the till matrix (ICP-MS).

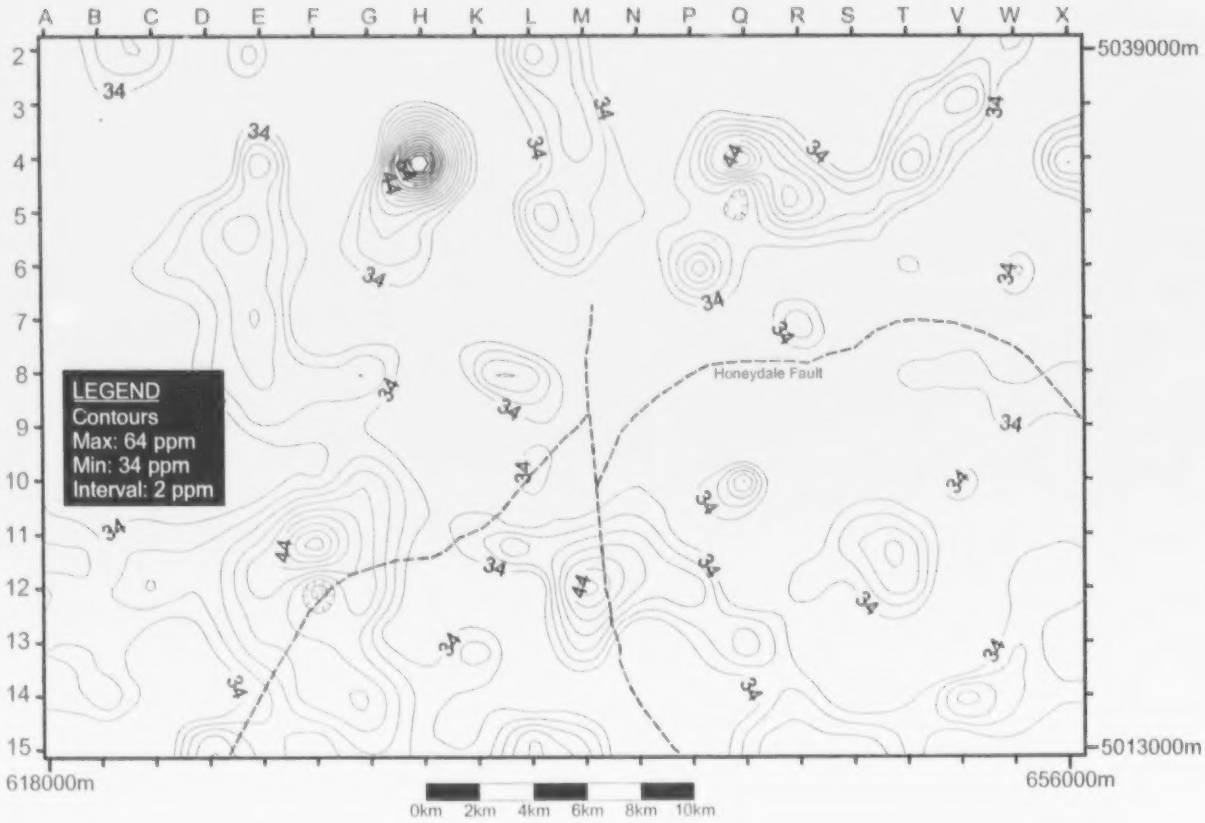

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
LEGEND
Contours
Max: 64 ppm
Min: 34 ppm
Interval: 2 ppm
Honeydale Fault
34
44
64
0km 2km 4km 6km 8km 10km

Fig. 5.17 - Chromium dispersal in the till matrix (ICP-MS).

Chromium. Evident in the chromium dispersal plot is a high-contrast southwesterly trending (~205°) anomaly (coordinates H-4; Fig. 5.17). It has a typical "amoeboid" configuration with the tail spanning a distance of approximately 6 km. Proximal to the east of this is a palimpsest anomaly set (coordinates L-2; Fig. 5.17) with a primary southeasterly trend (~160°) showing evidence of secondary dispersal towards the southwest (~205°).

It is likely that both of these dispersal orientations represent syngenetic distributions since chromium is immobile and therefore not subject to hydromorphic redistribution. By taking this into consideration the possibility arises that at least two depositional ice-flow paths affected the study area. One depositional ice-flow event is likely to have trended towards the southeast (~130°-160°) while the second towards the southwest (~205°). This is consistent with depositional trends defined by the clast medium as most clasts show dispersal towards the southeast (~135°) while intrusive lithologies exhibit evidence of dispersal towards the southwest (~200°).

5.4.2 Chalcophile Elements

Limited dispersal patterns are evident in the 14 chalcophile elements investigated. Anomalies are characterized by either a "bullseye" shape or "amoeboid" configuration with slight elongation of the tail (on the order of 1-3 km) with an exponential decline in concentration. The exceptions are discussed here.

Thallium. Evident in the thallium contour plot are well-defined palimpsest dispersal sets showing strong primary southeasterly dispersal (~130°) and secondary redistribution towards the southwest (~210°) (coordinates D-6, L-8; Fig. 5.18). This can

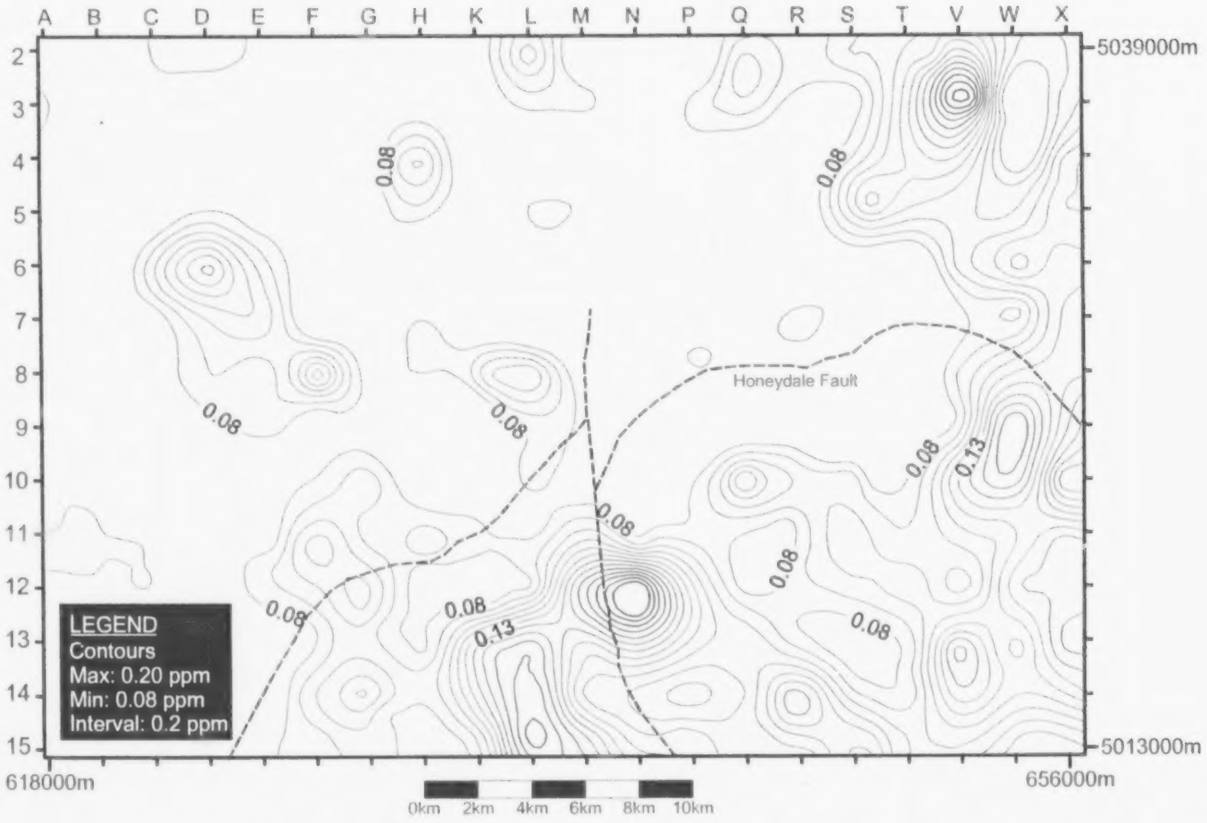

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
0.08
0.13
Honeydale Fault
LEGEND
Contours
Max: 0.20 ppm
Min: 0.08 ppm
Interval: 0.2 ppm
0km 2km 4km 6km 8km 10km

Fig. 5.18 - Thallium dispersal in the till matrix (ICP-MS).

be construed as further evidence for multiple depositional ice-flow events. Also, in the northeastern corner of the study area is an 8 km long southwesterly trending (~215°) dispersal train (coordinates V-3; Fig. 5.18).

Gallium. The gallium contour plot again shows evidence of both southeasterly and southwesterly trending dispersal. Located in the northeastern corner is a southwesterly trending (~210°) dispersal train propagating to distance of 8 km (coordinates V-3; Fig. 5.19). Another southwesterly trending (~210°) slightly elongated "bullseye" type anomaly is located at coordinates H-4 (Fig. 5.19). Also found throughout the study are small low-contrast gallium anomalies with dispersal tails elongated towards the southeast (coordinates D-6, L-2, S-2; Fig. 5.19). Because gallium is immobile and not susceptible to hydromorphic activity both the southeasterly and southwesterly trends are classified as syngenetic dispersal patterns.

Copper. Apparent in the copper contour plot is a 7 km long high-contrast dispersal train trending towards the southeast (~135°) (coordinates T-8; Fig. 5.20) and also another southeasterly trending anomaly at coordinates R-14; Fig. 5.20).

5.4.3 Siderophile Elements

Most siderophile elements show irregular dispersal patterns with no preferred alignment with respect to dispersal patterns. Of the 6 siderophile elements analyzed, only gold and molybdenum show significant dispersal parallel to depositional ice-flow orientations (~130°-150° and ~200°-220°) defined by striae and syngenetic patterns in the clast component as well as in the lithophile elements and chalcophile elements.

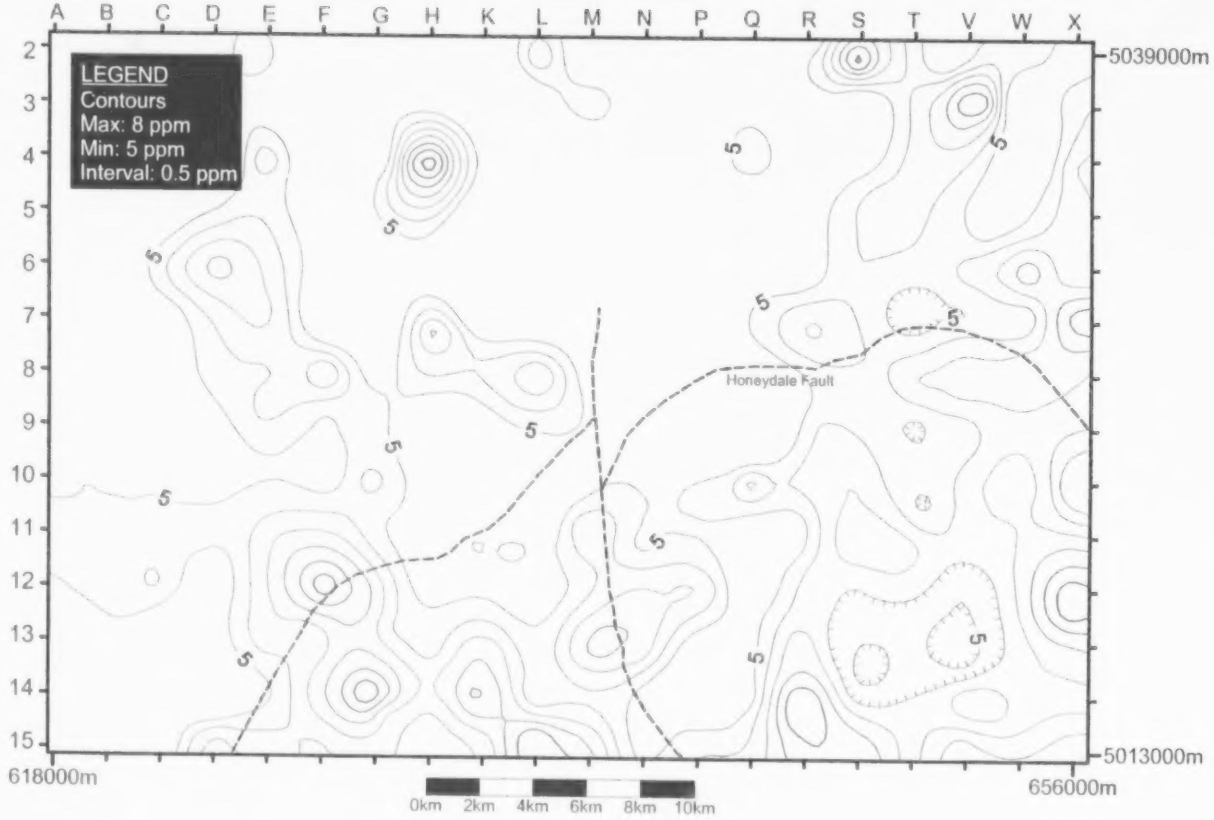

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
LEGEND
Contours
Max: 8 ppm
Min: 5 ppm
Interval: 0.5 ppm
5
Honeydale Fault
5039000m
5013000m
618000m
656000m
0km
2km
4km
6km
8km
10km

Fig. 5.19 - Gallium dispersal in the till matrix (ICP-MS).

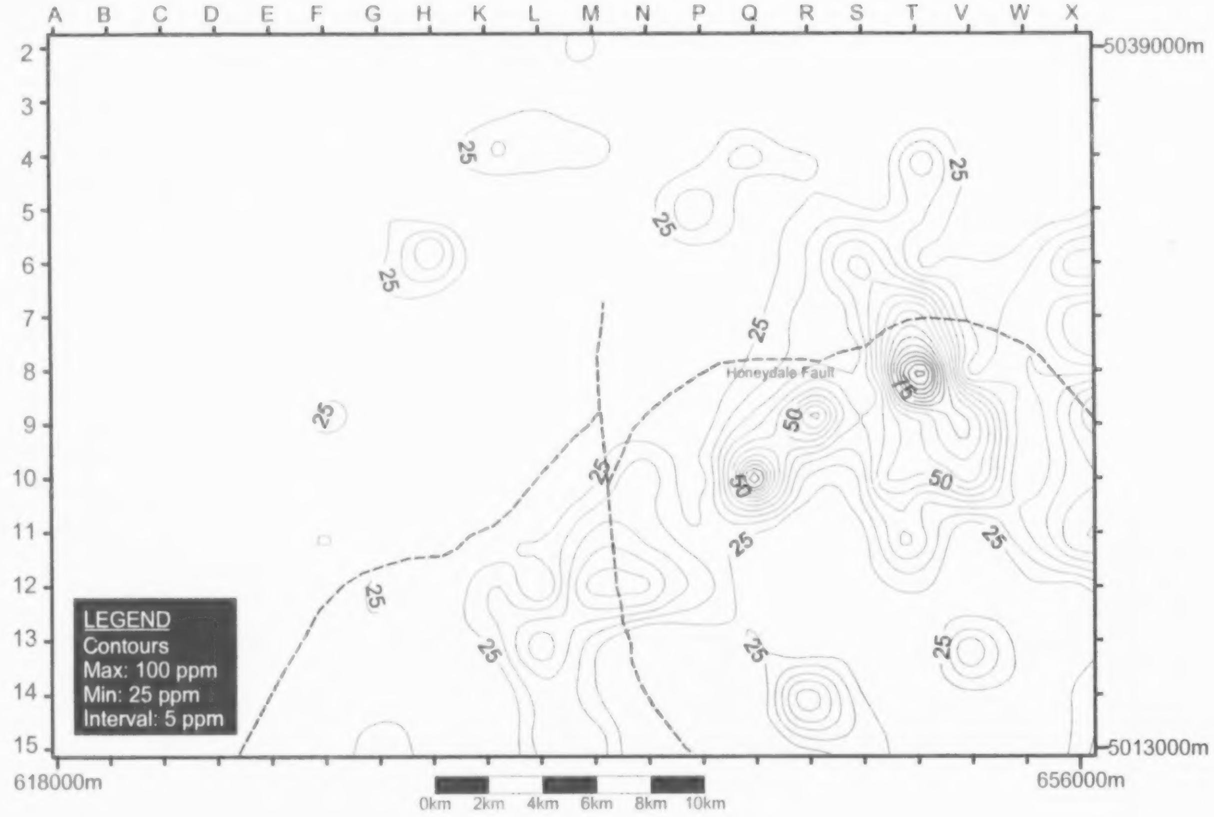

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
Honeydale Fault
25
50
75
LEGEND
Contours
Max: 100 ppm
Min: 25 ppm
Interval: 5 ppm
0km
2km
4km
6km
8km
10km

Fig. 5.20 - Copper dispersal in the till matrix (ICP-MS).

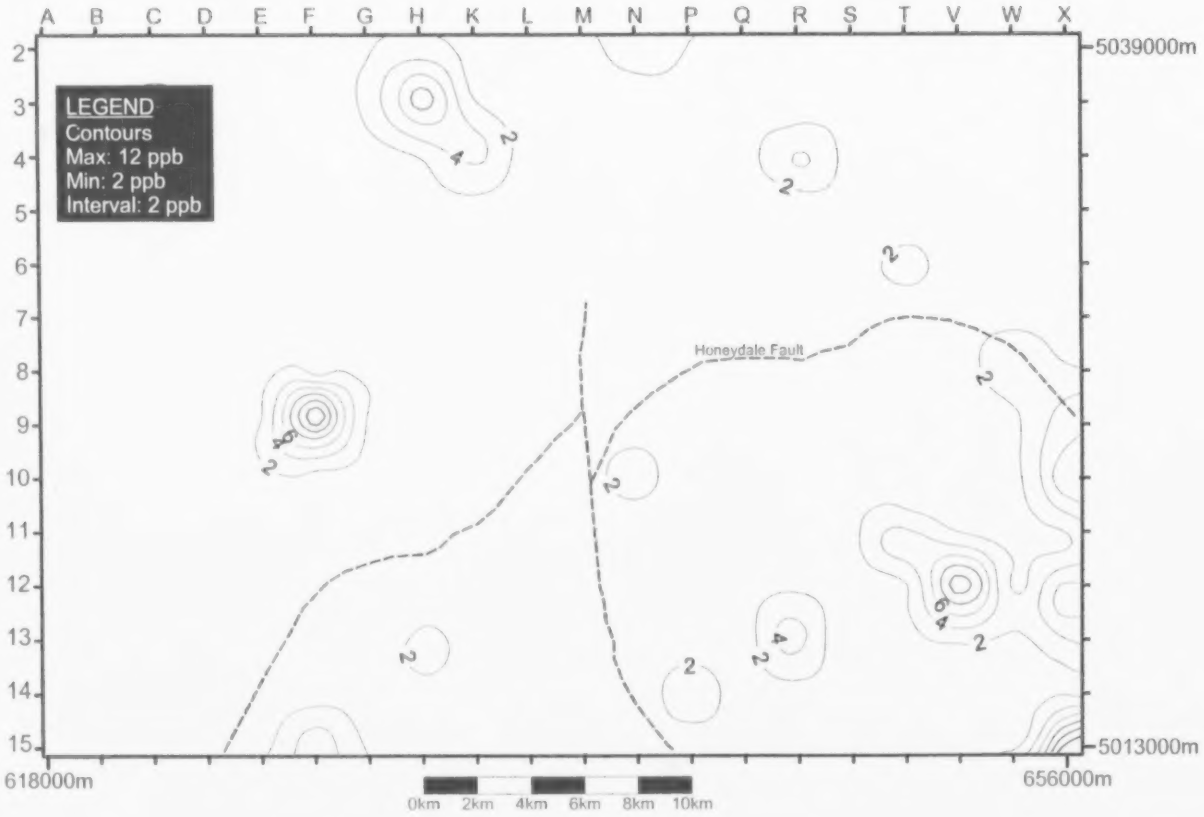

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
LEGEND
Contours
Max: 12 ppb
Min: 2 ppb
Interval: 2 ppb
Honeydale Fault
2
4
6
0km 2km 4km 6km 8km 10km

Fig. 5.21 - Gold dispersal in the till matrix (INAA).

Gold. Gold shows a small 5km long dispersal train elongated towards the southeast (~135°) emanating from coordinates H-3 (Fig. 5.21). Since gold is immobile this is interpreted as a syngenetic dispersion pattern.

Molybdenum. Although molybdenum is characteristic of high mobility and is susceptible to hydromorphic redistribution, a well-defined palimpsest anomaly in the south of the study area shows a strong primary dispersion towards the southeast for a distance of approximately 6 km (coordinates L-13; Fig. 5.22). This primary dispersion is interpreted as an indicator of depositional ice-flow (syngenetic), while the secondary dispersal fan propagating from the head of the anomaly towards the northeast is interpreted as being the result of some form of epigenetic redistribution.

5.4.4 Rare Earth Elements

The rare earth elements should in theory show well-defined syngenetic dispersal patterns that reflect the depositional flow path of the ice mass. This assumption is based on the fact that all rare earth elements, with the exception of uranium, are by nature immobile and therefore not subject to hydromorphic remobilization.

Evident in the ytterbium plot (Fig. 5.23), is a well-defined, 9 km long, ribbon-shaped dispersal train trending towards the southeast (~135°) (coordinates H-5; Fig. 5.23). This is construed as further evidence for southeasterly trending depositional flow. Apparent in the cesium plot (Fig. 5.24) are numerous short (3-5 km long) southeasterly trending skewed "bullseye"-shaped anomalies that can be distinguished across the study area (coordinates L-13, M-12, T-3; Fig. 5.24). Again these are oriented parallel to preconceived syngenetic dispersal patterns documented in the geochemical and clast

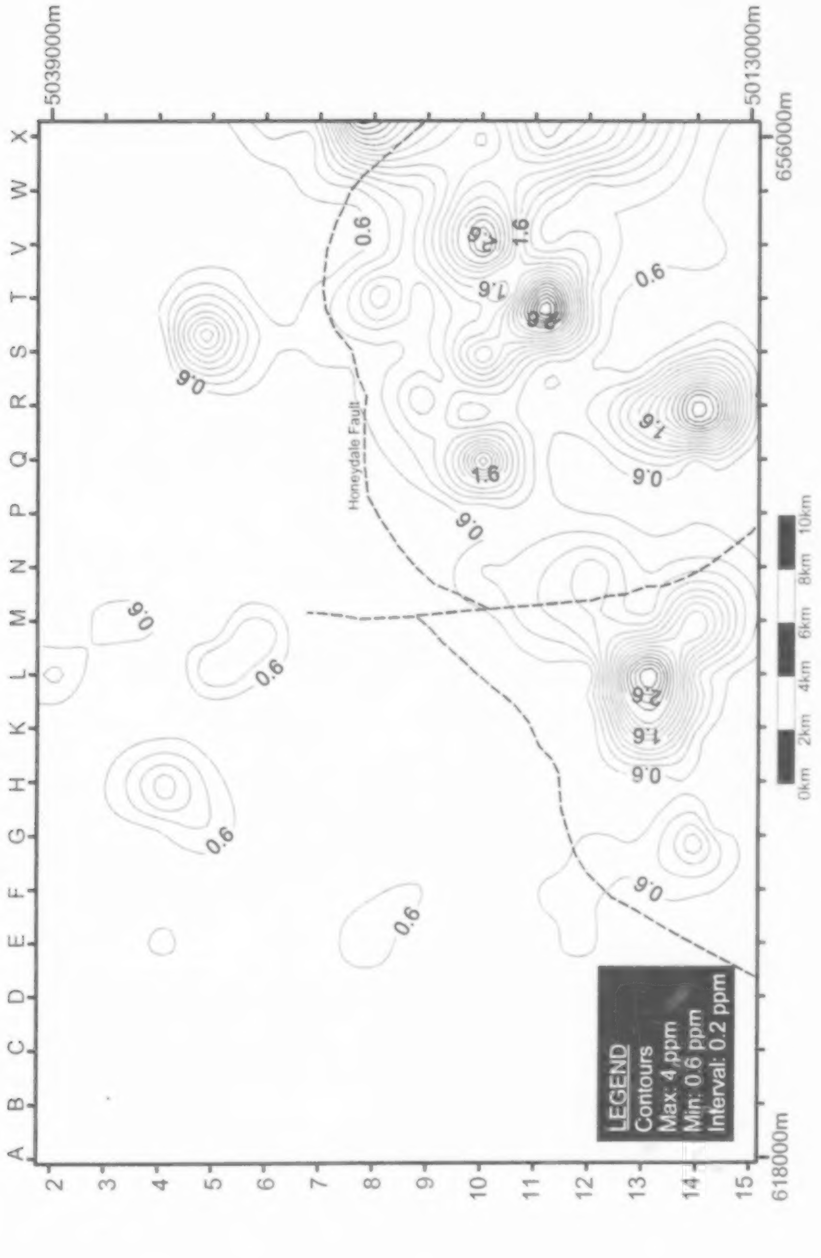

LEGEND
Contours
Max: 4 ppm
Min: 0.6 ppm
Interval: 0.2 ppm
Honeydale Fault
0.6
1.6
2.6
5039000m
5013000m
618000m
656000m
0km
2km
4km
6km
8km
10km
A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15

Fig. 5.22 - Molybdenum dispersal in the till matrix (ICP-MS).

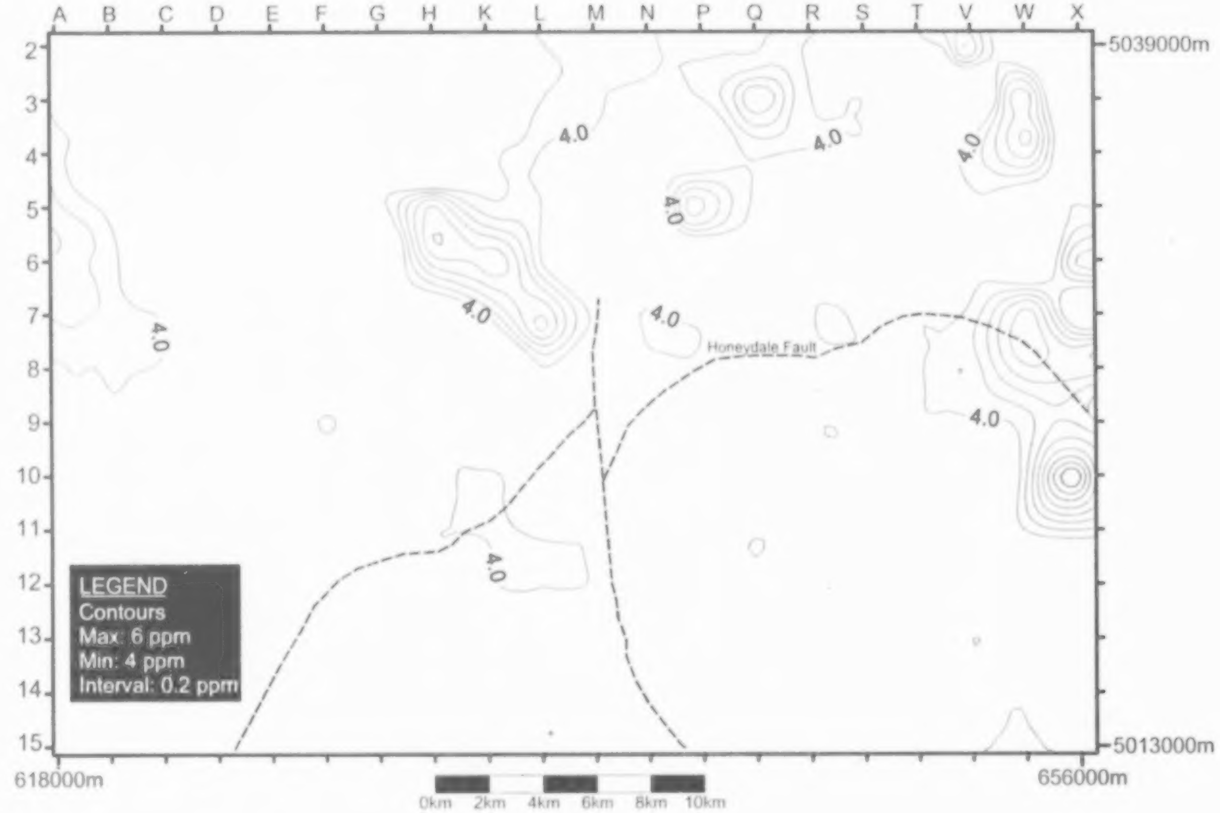

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
4.0
Honeydale Fault
LEGEND
Contours
Max: 6 ppm
Min: 4 ppm
Interval: 0.2 ppm
0km
2km
4km
6km
8km
10km

Fig.5.23 - Ytterbium dispersal in the till matrix (INAA).

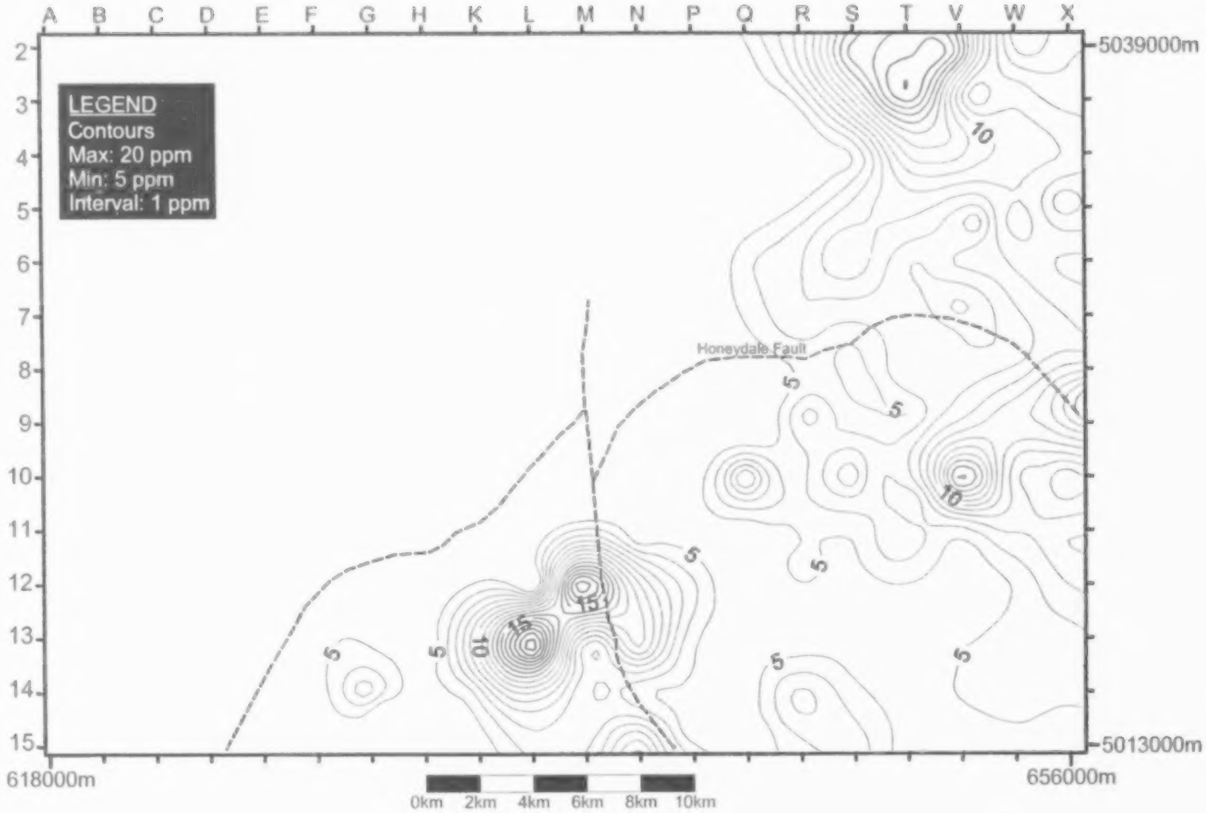

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
LEGEND
Contours
Max: 20 ppm
Min: 5 ppm
Interval: 1 ppm
Honeydale Fault
5
10
15
0km
2km
4km
6km
8km
10km

Fig. 5.24 - Cesium dispersal in the till matrix (INAA).

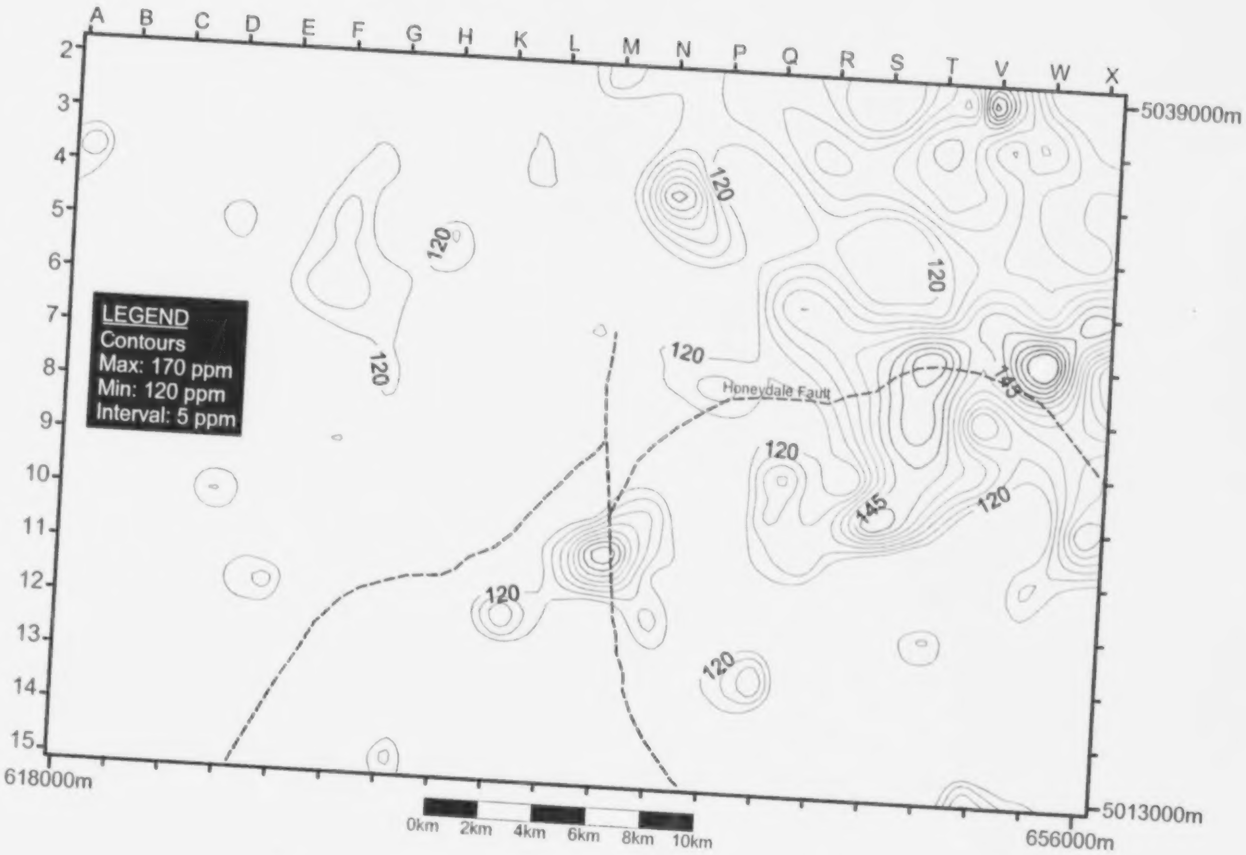

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
618000m
656000m
5039000m
5013000m
LEGEND
Contours
Max: 170 ppm
Min: 120 ppm
Interval: 5 ppm
120
145
Honeydale Fault
0km
2km
4km
6km
8km
10km

Fig. 5.25 - Cerium dispersal in the till matrix (INAA).

media. Like cesium, cerium (Fig. 5.25) shows numerous "bullseye" anomalies skewed towards the southeast (coordinates M-11, N-4, W-7; Fig. 5.25).

5.4.5 Regional Scale Geochemical Trends

The basal till population (ablation till samples removed) was split into two "sub-populations" for comparative purposes. Fyffe and Fricker (1987), in their tectonostratigraphic terrane analysis of New Brunswick, characterized the Honeydale Fault system (Fig. 1.5), which transects the study area, as the boundary between the St. Croix terrane to the southeast and the Fredericton Cover Sequence to the northwest. By treating the basal till in these different terranes as separate populations (although genetically equivalent), it could be established whether background geochemical values vary between the two terranes. To facilitate this exercise mean concentration of each element analyzed was calculated for basal till samples located in the Fredericton Cover Sequence and the St. Croix terrane. The results show that for most elements background mean geochemical values are greater in the St. Croix terrane. Only calcium, cesium, europium, hafnium, lutetium, samarium, strontium and tungsten show higher background concentrations in the Fredericton cover sequence. For a complete statistical treatment of the geochemical data refer to Appendix 5.

5.5 Statistical Correlations

To examine for statistical correlation among the granulometric, lithological and geochemical data Spearman's Rank Correlation analysis was conducted using WinSTAT® for Microsoft Excel Version 2001.1. Significant correlations are obvious among particular elements while only limited correlations exist between the geochemistry and granulometric parameters. Neither the geochemical or granulometric data show correlation with the lithological data.

As expected, common geochemical associations were apparent. Specific element correlations included: Al-Ga (r = 0.77); Ca-Sr (r = 0.68); Ni-Co (r = 0.76); Cu-Zn (0.56); Fe-Mo (r = 0.61); As-Sb (r = 0.52) and Pb-Zn (r = 0.59). Correlation between As-Sb is sometimes indicative of gold deposits while Fe-Cu-Mo association is usually indicative of porphyry copper deposits (Rose et al., 1979). Also evident is moderate correlation between Fe-Ni-Co, which is indicative of ores associated with mafic igneous rocks (Rose et al., 1979). Relatively strong positive correlation exists among the rare earth elements. In terms of correlation between geochemistry and granulometric parameters, the elements potassium, lanthanum, magnesium, sodium and rubidium show moderate to strong positive correlation with clay while hafnium is characterized by moderate negative correlation with clay and positive correlation with sand. For a complete listing of all significant correlations with 'r' values greater than |0.50| refer to Table 5.1.

5.6 Erosional Indicators

In conjunction with the till sampling program, attention was given to the examination of ice-flow directional indicators. Accurate measurement of striae, and other micro-fluting features, was conducted upon discovery and where possible chronological relationships were established. These data, combined with striae data obtained by Seaman, (1988), are tabulated (Table 5.2) and presented as a histogram (Fig. 5.26). Because of poor bedrock exposure in the study area and weathered bedrock surfaces in areas of reasonable exposure, only two sites yielded chronological striae data.

	Ag ppb ICP-MS	Al % ICP-MS	As ppm ICP-MS	Ba ppm ICP-MS	Bi ppm ICP-MS	Ca % ICP-MS	Cd ppm ICP-MS	Co ppm ICP-MS	Cr ppm ICP-MS	Cu ppm ICP-MS	Fe % ICP-MS	Ga ppm ICP-MS	Hg ppb ICP-MS	K % ICP-MS	La ppm ICP-MS	Mg % ICP-MS	Mn ppm ICP-MS	Mo ppm ICP-MS	Na % ICP-MS	Pb ppm ICP-MS	S % ICP-MS	Sb ppm ICP-MS	Sc ppm ICP-MS	Se ppm ICP-MS	Sr ppm ICP-MS	Th ppm ICP-MS	Tl ppm ICP-MS	U ppm ICP-MS	V ppm ICP-MS	W ppm ICP-MS	Zn ppm ICP-MS	Ce ppm INAA	Cs ppm INAA	Hf ppm INAA	Lu ppm INAA	Rb ppm INAA	Sm ppm INAA	Tb ppm INAA	%sand	%silt
Ag	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bi	-	0.54	0.81	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ca	-	-0.50	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	0.61	-	0.53	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Co	-	-	0.52	-	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cr	-	0.64	-	-	-	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cu	-	-	0.73	-	0.63	-	-	0.71	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fe	-	0.67	0.58	-	0.63	-	-	0.57	0.61	0.66	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ga	-	0.77	-	0.56	-	-	-	-	0.62	-	0.72	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hg	0.66	-	-	-	-	-	-	-	-	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	0.76	-	-	-	-	-	-	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
La	-	-	-	-	-	-	-	0.52	-	-	-	-	-0.56	0.57	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mg	-	-	-	0.64	-	-	-	0.61	0.54	-	-	-	-	0.67	0.55	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mn	-0.50	-	-	-	-	-	-	0.66	-	-	-	-	-0.53	0.63	0.56	0.53	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mo	-	0.55	0.52	-	0.56	-	-	-	-	-	0.61	0.54	-	-	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	0.51	-	-	-	-	-	-	-	-	-	0.66	0.53	-	0.55	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ni	-	-	-	-	-	-	-	0.76	0.55	0.54	0.59	-	-	-	-	0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pb	-	-	0.76	-	0.77	-	0.57	0.61	-	0.75	0.68	-	-	-	-	-	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sb	-	-	0.52	-	-	-	-	-	-	0.56	-	-	-	-	-	-	0.51	-	-	0.57	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sc	-	-	-	0.58	-	-	-	0.52	-	-	-	-	-	0.51	-	0.56	0.60	-	0.54	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Se	0.50	-	-	-	-	-	-	-	-	-	-	-	0.59	-	-	-	-	-	-	-	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sr	-	-	-	-	-	0.68	-	-	-	-	-	-	-0.61	0.51	-	-	0.56	-	-	-	-	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Te	-	-	0.56	-	0.52	-	-	-	-	0.63	0.57	-	-	-	-	-	-	-	-	0.61	-	-	-	-	-0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Th	-	-	-	-	0.57	-	-	0.58	-	0.61	-	-	-	-	0.71	-	-	-	-	0.58	-	0.55	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ti	-0.55	-	-	-	-	-	-	-	-	-	-	-	-0.55	0.61	-	-	0.62	-	0.57	-	-0.51	-	0.60	-	-	0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tl	-	0.64	-	-	0.54	-	-	-	-	-	-	0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-
U	-	-	0.51	-	0.61	-	-	-	-	-	-	-	-	-	-	-	-	0.50	-	-	-	-	-	-	-	0.52	-	1.00	-	-	-	-	-	-	-	-	-	-	-	-
V	-	0.62	-	0.54	-	-	-	-	-	-	0.61	0.75	-	0.51	-	-	-	-	-	-	-	-	0.54	-	-	-	0.69	-	1.00	-	-	-	-	-	-	-	-	-	-	-
W	-	-	0.58	-	0.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.60	-	-	1.00	-	-	-	-	-	-	-	-	-	-
Zn	-	0.67	0.54	-	0.59	-	-	-	-	0.56	0.81	0.66	-	-	-	-	-	0.61	-	0.59	-	-	-	-	-	-	-	-	-	-	1.00	-	-	-	-	-	-	-	-	-
Br	0.56	-	-	-	-	-	-	-	-	-	-	-	0.77	-	-0.50	-	-0.56	-	-	-	0.50	-	-	0.56	-0.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.59	-	-	-	-	-	1.00	-	-	-	-	-	-	-	-
Cs	-	0.58	0.60	-	0.78	-	-	-	-	-	0.59	0.62	-	-	-	-	-	-	-	0.55	-	-	-	-	-	0.52	0.64	0.59	0.51	0.59	0.62	-	1.00	-	-	-	-	-	-	-
Hf	-	-0.53	-	-0.53	-	-	-	-	-	-	-0.65	-0.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.62	-	-	1.00	-	-	-	-	-	-
Lu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.53	1.00	-	-	-	-	-
Rb	-	-	-	-	0.60	-	-	-	-	-	-	-	-	0.57	0.66	-	-	-	-	-	-	-	-	-	-	0.63	-	0.51	-	-	0.55	-	0.75	-	-	1.00	-	-	-	-
Sm	-	-	-	-	-	-	-	-	-	-	-	-	-0.56	-	0.63	-	-	-	-	-	-	-	-	-	-	0.55	-	-	-	-	-	0.76	-	-	0.63	-	1.00	-	-	-
Tb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.60	-	-	0.55	-	0.77	1.00	-	-
Th	-	-	-	-	0.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.73	-	0.55	-	-	-	0.77	-	-	-	0.50	0.69	0.55	-	-
Yb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.68	-	0.63	0.56	-	-
% sand	-	-	-	-0.51	-	-	-	-	-	-	-	-	-	-0.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.58	-	-	-	-	1.00	-
% silt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.78	1.00
% clay	-	-	-	-	-	-	-	-	-	-	-	-	-	0.79	0.54	0.65	-	-	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.62	-	0.50	-	-	-0.81	-

Table 5.1 - Selected results from Spearman's Rank Correlation. Note that only r values > |0.50| are shown.

UTM Eastings (NAD27)	UTM Northings (NAD27)	Striae Trend (degrees)
0619600	5034700	151
		172
0619600	5034700	104
		117
		141
		226
0622400	5037900	124
		137
0623100	5018300	73
		133
		141
		148
		157
0624100	5017700	153
0625000	5038600	90
		101
		108
		117
		121
		131
		137
		174
		180
0625100	5025400	100
		108
		145
0638600	5009400	95
		105
		116
		121
		128
		190
		203
0625300	5015200	149
0625400	5025400	144
0625500	5038600	131
		140
		147
0626500	5025600	150
0626800	5024200	134
		140
		149
		158
		171
0626900	5025300	142
		151
		162
		173
0623900	5012300	123
		131
		140
		149
		160
		167
0630300	5021500	141
0631000	5020300	131
		141
		149
		170
0633000	5027800	110
		131
0628200	5010800	108
		116
		123
		129
		141
0616000	5013000	131
		141
		150
		160
		167
		180
0633300	5028700	117
		123
		130
0633600	5027900	111
		122
		129
0633700	5027900	105
		121
		130
		137
0633800	5027900	115
		123
		129
0619350	5035400	145
0619750	5036800	145
0621200	5015900	155
0629750	5020150	100
0632500	5028650	131
0633300	5028800	125
0634250	5029250	103
		136
0633000	5025500	114
		130
0632000	5020100	100
		120
0633250	5016000	137
		147
0645350	5013700	125
		159
0649300	5014000	122
		132
		172
0651500	5013500	112
0649300	5039000	75
		80
		100
		210

Table 5.2 - Orientations and locations of striae throughout the study area. Compiled striae orientations include striae measured by Seaman, 1988 and observations made by Seaman in 1989 (written communication, April 2002) as well as striae recorded by the author, Toon Pronk (NBDNRE) and Rex Boldon (NBDNRE) during field work in the area.

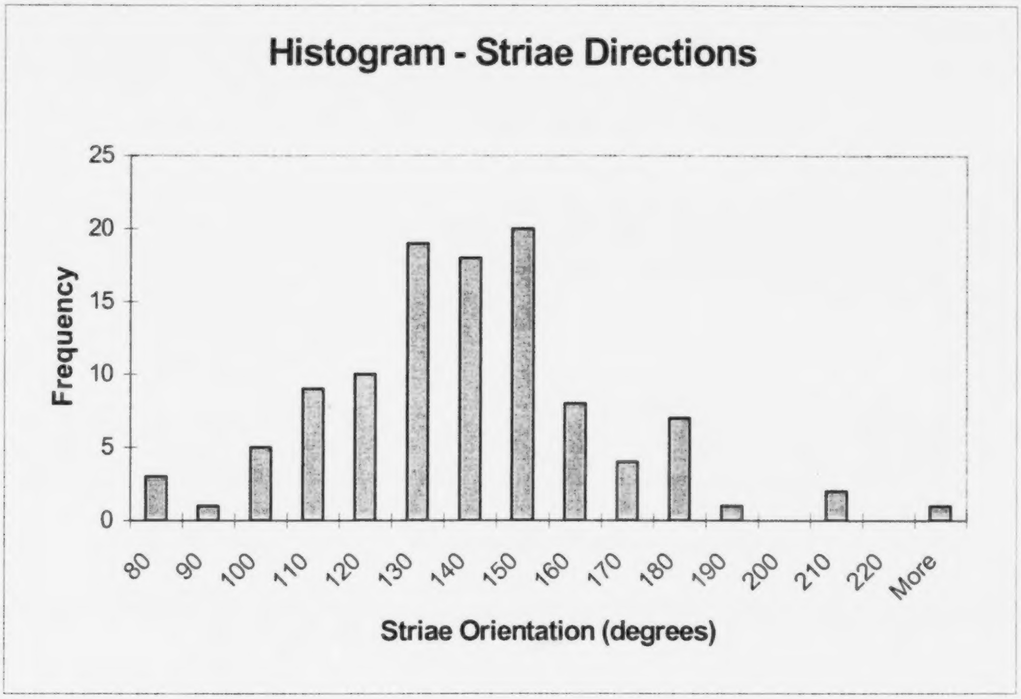


Fig. 5.26 – Histogram showing frequency distribution of striae orientation throughout the study area. Compiled striae orientations include striae measured by Seaman, 1988 and observations made by Seaman in 1989 (written communication, April, 2002) as well as striae recorded by the author, Toon Pronk (NBDNRE), and Rex Boldon (NBDNRE) during field work in the area.

One site demonstrated the following chronology: (1) 100°, (2) 75-80°, (3) 210° (Plate 5.3), while the chronology deduced at the other site was: (1) 159°, (2) 125°.

The terrain surface of the study area is undulating due to the widespread occurrence of streamlined ridges aligned in a northwest-southeast direction. These ridges are the result of extensive glacial fluting and drumlinization and can clearly be seen on aerial photographs or contour maps of the study area. Orientation of these ridges and drumlins ranges from approximately 130°-145° and hence define the dominant erosional ice-flow orientation traversing the study area.

5.7 Till Fabric Analysis

Till fabric analysis was conducted at four localities within the study area (Fig. 5.27). Sections of lodgement till were selected for analysis only if the following criteria were met: (1) acceptable vertical profile (road cut or excavation); (2) matrix-supported fabric; (3) high degree of compactness; and (4) practical availability of elongated clasts. A total of 25 clasts were examined at three of the sites while 20 were examined at the fourth site.

Only clasts exhibiting a 1.5:1 length to width ratio were used and these clasts were characterized spatially by noting their orientation and dip, and then measured along their length (a-axis) and width (b-axis) (Table 5.3a, 5.3b). To examine the till fabric data for evidence of preferred trend, rose diagrams were constructed using the Oriana for Windows 1.06® program (Fig. 5.28). Till fabrics #1, #2, and #3 all show strong clast alignment towards the south-southwest (~200° to 220°) with only slight variation, while till fabric #4 shows strong alignment towards the southeast (~140°) as well as moderate alignment towards the south (~180°) and south-southwest (~205°). These results again confirm that two depositional ice-flow events affected the study area, one trending towards the southeast and another trending towards the south-southwest.

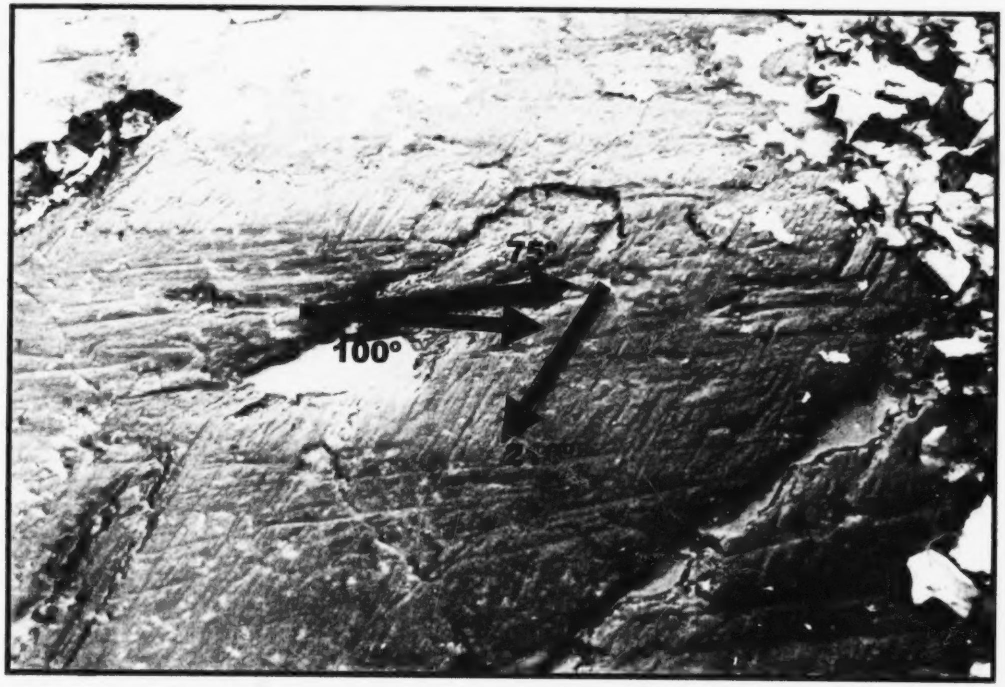


Plate 5.3 - Striated bedrock (Shin Formation) found at Summer Hill (Fig. 1.2b) in the northeastern corner of the study area. The chronology deduced was (1) 100°, (2) 75-80° and (3) 210°.

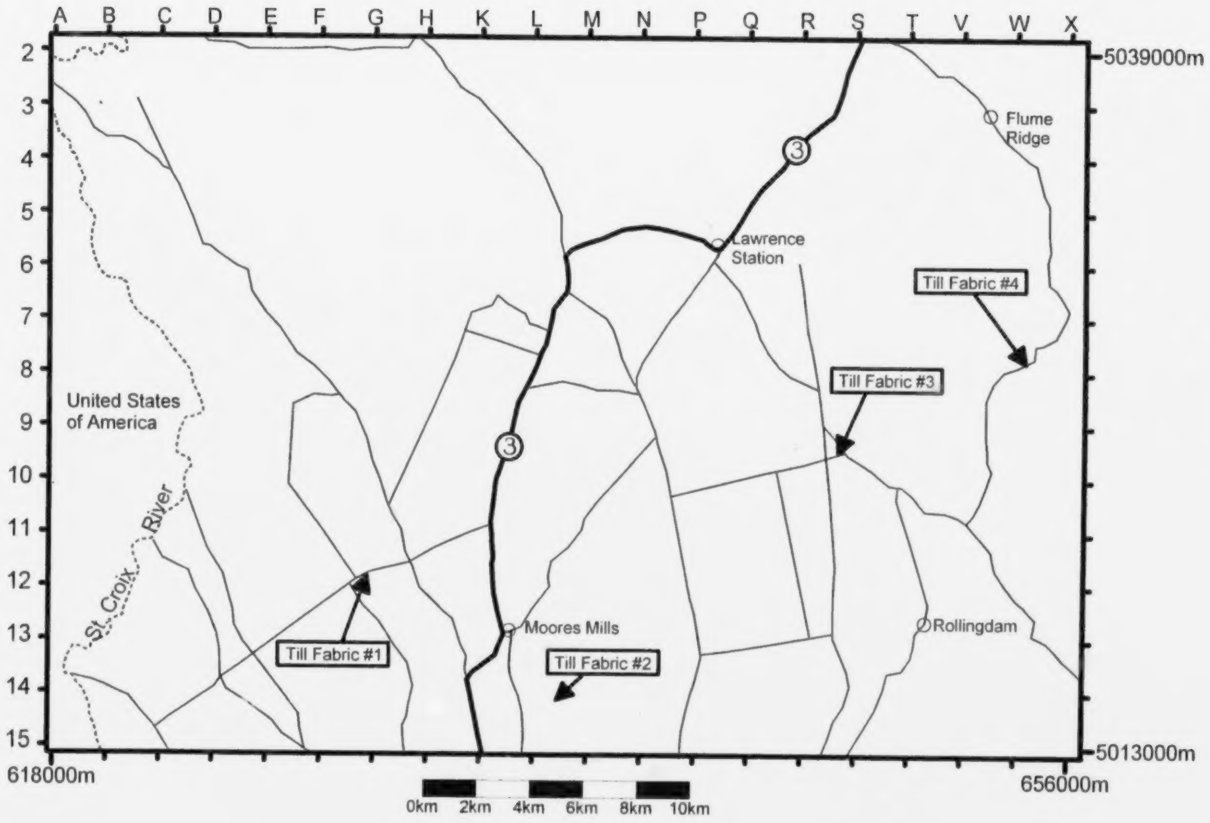

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
Flume Ridge
Lawrence Station
Till Fabric #4
Till Fabric #3
Till Fabric #2
Till Fabric #1
Moores Mills
Rollingdam
United States of America
St. Croix River
3
0km 2km 4km 6km 8km 10km

Fig. 5.27 - Locations of till fabrics examined throughout the study area.

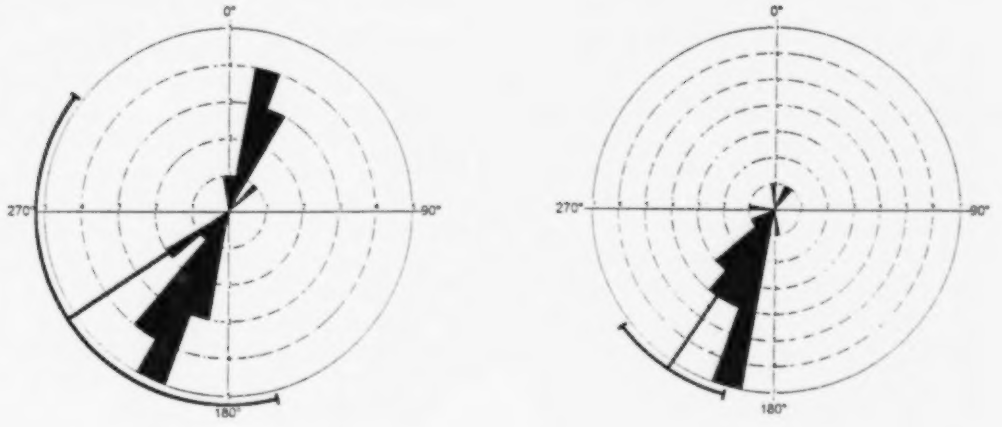
Till Fabric #1	UTM: 0629824, 5018618				Till Fabric #2	UTM: 0638109, 5013103			
Orientation	**Dip** (degees)	**a-axis** (cm)	**b-axis** (cm)	**a/b**	**Orientation**	**Dip** (degees)	**a-axis** (cm)	**b-axis** (cm)	**a/b**
014	8	15	9	1.67	280	2	5.5	3	1.83
022	25	6	2.5	2.40	230	10	5	3	1.67
026	12	18	9	2.00	199	17	10	6	1.67
006	7	7	4.5	1.56	231	0	6	3.5	1.71
014	20	5.5	2.5	2.20	213	0	8.5	4.5	1.89
211	8	11	6.5	1.69	192	0	7	3.5	2.00
220	16	9	5	1.80	032	4	6	3.5	1.71
026	2	5.5	3	1.83	249	0	8.5	4	2.13
226	15	6	3.5	1.71	193	0	12	6	2.00
212	2	6	3	2.00	196	0	5.5	3	1.83
018	10	5	2.5	2.00	213	0	3	1.5	2.00
041	10	7.5	3.5	2.14	172	0	4	2	2.00
210	18	5.5	3	1.83	351	5	5.5	2	2.75
192	12	8.5	5	1.70	197	0	4.5	3	1.50
000	25	4.5	1	4.50	213	3	6	2.5	2.40
194	5	10.5	6	1.75	219	2	4.5	2.5	1.80
194	8	8	4.5	1.78	021	3	4	2	2.00
214	22	4	2.5	1.60	227	0	3	1.5	2.00
210	6	14	7.5	1.87	203	0	3	1.5	2.00
206	12	6	4	1.50	206	0	6	3	2.00
209	17	5.5	3	1.83	203	2	3	1.5	2.00
240	0	4.5	2	2.25	199	2	4	2.5	1.60
017	12	8.5	4	2.13	203	3	7	3.5	2.00
235	4	6.5	3.5	1.86	224	3	5	2.5	2.00
205	7	10	5	2.00	200	0	5	3	1.67

Table 5.3a - Results of Till Fabric #1 and Till Fabric #2.

Till Fabric #3	UTM: 0647406, 5023985				Till Fabric #4	UTM: 0653721, 5027324			
Orientation	**Dip** (degees)	**a-axis** (cm)	**b-axis** (cm)	**a/b**	**Orientation**	**Dip** (degees)	**a-axis** (cm)	**b-axis** (cm)	**a/b**
210	0	10	5	2.00	204	0	20	12	1.67
202	0	6.5	4	1.63	007	25	9	5	1.80
092	4	8	4	2.00	180	0	5	2.5	2.00
198	4	12	6	2.00	140	0	6	3	2.00
210	0	4	2	2.00	131	0	6	3	2.00
232	0	4	2	2.00	174	0	8	4	2.00
177	5	5.5	3	1.83	140	0	5	2	2.50
044	17	10	5.5	1.82	139	5	12	6.5	1.85
200	0	4	2	2.00	142	3	5.5	3.5	1.57
025	10	4	1.5	2.67	205	2	12	5	2.40
202	3	3.5	2	1.75	111	0	15	7.5	2.00
210	2	5	3	1.67	326	6	4.5	2.5	1.80
207	0	4	2.5	1.60	142	0	4	2.5	1.60
190	0	4	2.5	1.60	320	2	3.5	1	3.50
215	0	3.5	2	1.75	109	0	4.5	1.5	3.00
165	0	3.5	2	1.75	315	3	6.5	2.5	2.60
218	0	4	2.5	1.60	134	0	8	5	1.60
198	0	6	4	1.50	128	0	3.5	1.5	2.33
210	0	4	2.5	1.60	136	0	3.5	1	3.50
205	8	6	4	1.50	126	0	4	2.5	1.60
205	0	2.5	1	2.50					
204	0	4	2.5	1.60					
184	18	5	2	2.50					
205	0	3	1.5	2.00					
209	0	3.5	1.5	2.33					

Table 5.3b - Results of Till Fabric #3 and Till Fabric #4.

Till Fabric #1 **Till Fabric #2**



Till Fabric #3 **Till Fabric #4**

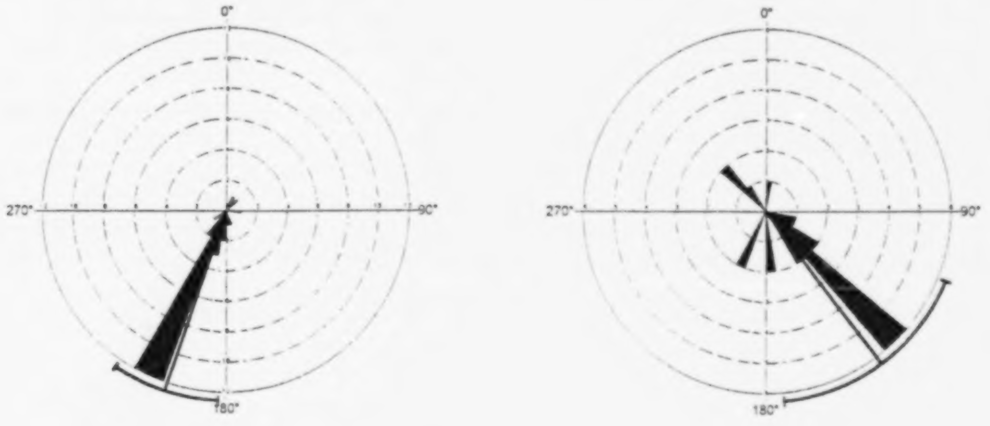


Fig. 5.28 – Rose diagrams of till fabrics examined in the study area.

CHAPTER 6

DISCUSSION

6.1 Depositional Ice-Flow Paths

The presence of multiple syngenetic dispersal train orientations in various clast and geochemical components of the area till indicates that two depositional ice flow events affected the study area during the Wisconsinan episode of glaciation; one flowing towards the southeast (~130°-150°) and the other flowing towards the south-southwest (~200°-220°). These trends are apparent in the striae record and in the case of the southeastward trend; dispersal is parallel to the orientation of the numerous megaflutes and drumlins characteristic of the study area. As discussed in Chapter 5, section 5.7, till fabric analyses confirm these findings. Palimpsest geochemical anomalies, as well as isolated palimpsest landforms in the northwestern corner of the study area, indicate that these depositional events were successive and characteristic of a relatively rapid transition from one orientation to the other. Scenarios which integrate these depositional flow paths into a regional context will be presented in section 6.2

6.1.1 Southeastward Dispersal

Southeastward dispersal (~130° to 150°) is best defined in the clast component by dispersal trains emanating from the Shin Formation occurrences. The combined maroon clast plot (Fig. 5.10) represents total dispersal from this unit. It demonstrates the longest single dispersal train traversing the study area, by spanning a distance of at least 23 km, and possibly up to 36 km, if it is assumed that the farthest traveled clast was displaced along the southeastward dispersal trend. Among the elements, southeasterly dispersal is common and best represented by strontium, which shows a 12 km long southeastward trending anomaly (Fig. 5.16). This depositional flow path is consistent with the overall trend of erosive glacial landforms in the study area, hence indicating that the ice-flow event responsible for creating the observed dispersal patterns was characteristic of an efficient balance between erosion and deposition. Seaman et al. (1993) attributed the creation of these landforms to ice activity during the Early Wisconsinan (>53 ka B.P.) and related this to the Caledonia flow pattern or Caledonia phase of Rampton et al. 1984.

6.1.2 South-southwestward Dispersal

Only limited evidence of south-southwestward dispersal (~ 200° to 220°) can be discerned in the clast medium. Evidence of dispersal along this trend is restricted to the felsic volcanic clast plot (Fig. 5.14). Despite this, numerous south-southwesterly aligned geochemical anomalies are apparent among the elements. Thallium (Fig. 5.18), gallium (Fig. 5.19) and chromium (Fig. 5.17) all show well-defined dispersal trains elongated towards the south-southwest. In addition to this, palimpsest anomaly sets can be discerned that show southeasterly trending anomalies re-dispersed towards the south-southwest (e.g., thallium, chromium) and also, till fabrics show a dominant south-southwestward alignment.

There is a low incidence of south-southwesterly aligned striae and an absence of well-defined south-southwesterly aligned landforms in the study area; therefore it is assumed that only limited erosion occurred during this ice flow event. It is expected that the south-southwesterly dispersal patterns represent evidence of a Late Wisconsinan flow that occurred after initial till deposition. This layer of till, deposited during the early southeasterly flow phase, shielded the underlying bedrock, thereby preventing it from being scoured to any great extent by later ice-flows. These concepts and the method used for defining a definitive chronology of events are discussed in the following section.

6.1.3 Chronology of Events

To establish a chronology of depositional ice-flow events, till fabric analysis was used. The results show that basal till throughout the study area is characterized by a strong fabric alignment towards the south-southwest with some areas representative of a remnant alignment towards the southeast in cases where this initial fabric was fortuitously preserved (Chapter 5, section 5.7). This chronology of fabric alignment is deduced by examining the relationship between erosional landforms produced during the southeasterly trending flow event and current till fabric orientation.

Integral to this deduction is the observation that till fabric is aligned towards the south-southwest in areas characterized by a strong southeasterly landform alignment. The implication of this is that southeasterly erosion and dispersal must have pre-dated south-southwesterly dispersal. A south-southwesterly trending till fabric would not have been preserved if the converse were true, as it would have been destroyed by the highly erosive southeasterly trending ice-flow phase. Evidence presented herein indicates that the most recent depositional ice-flow event moved towards the south-southwest (~200° to 220°).

Although two distinct transport paths affected the study area during the Late Wisconsinan, only one stratigraphic basal till unit was encountered. Adhering to the chronology, this till was deposited during the initial southeasterly trending event and then only reworked during the late event. In this scenario the late south-southwesterly ice flow (200° to 220°) did not produce a recognizable deposit but instead it left its mark by altering the pre-existing till (e.g., Broster and Dreimanis, 1981). This alteration takes the form of a modest redistribution of the till matrix and, to a lesser extent, the clast component as well as a re-alignment of the till fabric towards the south-southwest.

Stea and Finck (2001) refer to the process of imprinting matrix, clasts or fabric components on older tills as 'overprinting', and Grant (1963) defines a 'hybrid' till as a till whose properties were defined by the re-working of pre-deposited till by the action of overriding ice. By adhering to this nomenclature it can be stated that 'hybrid' till characteristic of an 'overprinting' relationship blankets much of the map area.

6.2 Regional Ice-Flow Models

In this section the question of how to integrate the two depositional flow paths delineated in this study into a regional context is addressed. As discussed in Chapter 4, it is now accepted that, during the Wisconsinan, New Brunswick was greatly affected by local ice caps centred in the Appalachian chain referred to in recent literature as the Appalachian Ice Complex (Stea and Finck, 2001). It has been theorized by Rampton et al. (1984) that the Laurentide Ice Sheet did not penetrate southwestern New Brunswick during the Wisconsinan but rather was blocked by local ice domes centred in northern Maine and the Gaspé Peninsula. Also, Rampton et al. (1984) postulate that glaciation of southwestern New Brunswick was accomplished by expanding ice domes centred in Maine (North Maine Ice Divide) and the New Brunswick lowlands (Gaspereau Ice Centre). The North Maine Ice Divide ice is described as following a southeasterly ice-flow trajectory while the Gaspereau-derived ice is said to have flowed towards the south and southwest (Rampton et al., 1984).

In light of this information it seems obvious as to how to integrate the depositional ice-flow paths delineated in this study into the current glaciation model of southwestern New Brunswick. One could simply attribute the southeasterly flow trajectory to the action of ice derived from the North Maine Ice Divide and the south-southwesterly trajectory to Gaspereau ice activity. There are problems with this however.

Today there exists controversy (e.g., Seaman et al., 1993; Pronk, personal communication June 2002) as to the plausibility of an ice dome having grown and occupied the New Brunswick lowlands (Gaspereau Ice Centre (Rampton et al., 1984)). This controversy is hinged on the fact that the mechanics involved leading to the formation of an ice centre in a lowland basin environment are not fully understood. If, in fact, an ice dome did occupy the New Brunswick lowlands, it is likely that it was formed as a result of ice inundating the area by means of growth of an ice dome centered in northern New Brunswick (Pronk et al., 1989), followed by a detachment event that resulted in a substantial amount of free ice occupying the New Brunswick lowlands (Pronk, personal communication June 2002). If this ice was in place, it is conceivable that it may have expanded and affected southwestern New Brunswick through interference of the local north Maine derived ice mass.

This interference or 'bump' from the east-northeast could have resulted in a shift in the outflow orientation of the local ice mass and could theoretically have produced the south-southwesterly transport trajectory delineated in this study. Rampton et al., (1984) place the contact between the North Maine derived ice and proposed Gaspereau ice in southwestern New Brunswick and describe the nature of the contact as being dynamic and characteristic of competing ice lobes with alternating times of dominance. Despite this, no definitive evidence of alternating dominance was found while working in the study area or deduced from data produced from this study. Rather, it seems that there existed a strong southeasterly trending ice flow event (~130°-150°), leaving behind a record of erosional and depositional landforms followed by a relatively weak less-erosive flow event trending towards the south-southwest (~210°-220°).

Another possibility, although highly unlikely, is that there was a southeasterly ice advance followed by a retreat and a later readvance towards the south-southwest. Because only one stratigraphic basal till unit (hybrid till) was encountered in the study area, it is probable that there was no retreat and readvance. A more complex stratigraphy would be expected in the case of retreat and readvance. As discussed above, a change in outflow orientation could have been caused by interference from another ice mass, but another possibility is that it was facilitated by a shift in the accumulation centre of the ice mass (e.g., Stumpf, 2001).

A plausible theory, proposed by Seaman et al., (1993), is that climatic changes over time may have caused a shift in the accumulation and ablation zones of the local ice mass thereby facilitating the observed shift in outflow orientation. This is a plausible model as climate was likely dynamic in southern New Brunswick during the Late Wisconsinan due to the proximity of the continental ice margin. In such an environment changes in precipitation patterns and storm paths are conceivable and may have easily facilitated a shift in accumulation/ablation zones resulting in the observed flow paths.

What caused this shift in flow-path orientation is still up for speculation. However, it can be said with certainty from the results of this study that only one stratigraphic till unit ('hybrid' till) resulted from two successive depositional ice-flow events and it is likely that these transport paths represent a successive change in flow direction within a common ice sheet.

CHAPTER 7

CONCLUSIONS

Having undergone a complex Wisconsinan glaciation involving multidirectional glacial flows, likely within a common ice sheet, followed by large-scale ice stagnation, the Rollingdam map area (NTS 21 G/06) presents unique challenges to drift exploration. The conclusions derived from this report, which are listed below, reflect the broad scope of this project. They are meant to provide insight into the glacial processes at work and their implications to any future drift prospecting exercises undertaken in the area.

1. Wisconsinan depositional ice flow trajectories have been delineated by examining dispersal patterns in the clast and geochemical mediums, as well as by conducting till fabric analysis. Chronologically, the first depositional event indicates flow towards the southeast (~130° to 150°) while the much weaker second event followed a south-southwesterly trajectory (~210° to 220°). Both trends are apparent in the striae record. In the case of the southeasterly trend, dispersal is parallel to major megafluting and drumlinization characteristic of the study area. Major displacement of debris occurred along the southeasterly trend (approximately 23-36 km) while only limited dispersal occurred along the south-southwesterly trend (up to 12 km).

2. Although two depositional ice-flow phases were delineated, only one stratigraphic basal till unit, consisting of both basal melt-out till and lodgement till, was encountered in the study area. This basal till unit was deposited during the initial southeasterly trending ice-flow event and then only reworked (imprinted) during the

secondary south-southwesterly trending event. In this scenario the younger event did not produce a recognizable deposit but instead left its mark by altering the pre-existing till through moderate redistribution of the till matrix, realignment of the till fabric and, to a lesser extent, redistribution of the clast components. The result is a 'hybrid till'.

3. Basal till throughout the study area is predominantly comprised of locally derived fragmental rock material with colour and texture reflective of the local bedrock units. In the till clast medium dispersal trains are evident for distances up to approximately 23-36 km and tend to accentuate the dominant southeasterly transport path more clearly than matrix geochemistry dispersal trains. Transport distances are limited to 12 km or less in the geochemical medium, as demonstrated by dispersal trains that often occur as high-contrast 'bulls-eye'- or 'amoeboid'-shaped anomalies with an exponential decrease in concentration just down ice of the presumed source. Among some elements geochemical dispersal is likely complicated by some degree of epigenetic redistribution, especially in the eastern half of the study area. Also, matrix particles are more susceptible to minor secondary glacial dispersal than the clast component. These results imply that for simple drift prospecting exercises in areas of complex glacial history, transport path and source unit are more clearly delineated by shape and size of till clast dispersal patterns, than by analysis of matrix geochemistry. However, to fully delineate the depositional history of a till sheet a comprehensive but cautious examination of the till geochemistry is required.

4. The Honeydale Fault system, which transects the study area, is the boundary between the St. Croix terrane to the southeast and the Fredericton Cover Sequence to the northwest. By treating the basal till data (ablation removed) in these different terranes as separate populations, it was found that for most elements background geochemical levels are higher in the St. Croix terrane. Only eight of the forty-nine elements analyzed show higher background concentrations in the Fredericton cover sequence, demonstrating that the potential for mineralization is greater in the St. Croix terrane.

5. Extensive wasting and stagnation of local ice near the end of the Late Wisconsinan resulted in an abundance of ablation till draped intermittently throughout the study area. The ablation till is presumed to be of local derivation, as is the basal till, and is dominated by material which was entrained and later released from the englacial zone of the ice mass. Compressive flow and up-shearing near the terminus of the ice mass would have facilitated the inclusion of large quantities of basal debris into the englacial zone.

6. Till sampling at a density of one sample per 4 km^2 and analysis of the silt plus clay (<0.063 mm) fraction of the sample is sufficient for identifying regional scale geochemical trends.

REFERENCES

BALZER, S. A. 1992. Quaternary geology and dispersal patterns of the Canterbury area, New Brunswick. New Brunswick Department of Natural Resources and Energy, Mineral Resources, Open File Report **92-5**, 192 p.

BALZER, S. A. and BROSTER, B. E. 1994. Comparison of clast and matrix dispersal in till: Canterbury area, New Brunswick. Atlantic Geology, **30**, 9-17

BENNET, M. R. and GLASSER, N. F. 1996. Glacial Geology: Ice Sheets and Landforms. Wiley and Sons Ltd., England, 364 p.

BOSTOCK, H. S. 1970. Physiographic subdivisions of Canada. *In* Geology and economic minerals of Canada. *Edited by* R. J. W. Douglas. Geological Survey of Canada. Economic Geology Report **1**, 10-30.

BOUYOUCOS, G. J. 1962. Hydrometer method improved for making particle size analyses of soils. Agronomy Journal, **54**, 464-465.

BRODZIKOWSKI, K. and VAN LOON, A. J. 1987. A systematic classification of glacial and periglacial environments, facies, and deposits. Earth-Science Reviews, **24**, 297-381.

BROSTER, B. E. and DRIEMANIS, A. 1981. Deposition of multiple lodgement tills by competing glacial flows in a common ice sheet; Cranbrook, British Columbia. Journal of Arctic and Alpine Research, **13**, 197-204.

BROSTER, B. E. and HUNTLEY, D. H. 1995. Effective low-cost reconnaissance drift prospecting in areas of variable terrain: An example from the south-east Taseko Lakes area, central British Columbia. *In* Drift exploration in the Canadian Cordillera. *Edited by* P. T. Bobrowsky, S. J. Sibbick, J. M. Newell and P. F. Matysek, Mineral Resources Division, Geological Survey Branch, Paper **1995-2**, 121-126.

CHALMERS, R. 1890. Report on the surface geology of southwestern New Brunswick. Geological Survey of Canada, Summary Report **1889**, v.**IV**, Report N, 87 p.

CHISWELL, P. G. 1992. Surficial geology and till geochemistry of the Rollingdam map area (NTS 21G/6), Charlotte county, New Brunswick, New Brunswick Department of Natural Resources and Energy, Mineral Resources, Manuscript, 21 p.

COKER, W. B. and DILABIO, R. N. 1989. Geochemical exploration in glaciated terrain: geochemical responses. *In* Proceedings of Exploration '87. *Edited by* G. D. Garland, Third Decennial International Conference on Geochemical Exploration for Minerals and Groundwater. Ontario Geological Survey, Special Volume, **3**, 336-383.

DILABIO, R. N. 1988. Residence sites of gold, PGE and rare lithophile elements in till. *In* Prospecting in areas of glaciated terrain-1988. *Edited by* D. R. MacDonald and K. A. Mills. Canadian Institute of Mining and Metallurgy. Department of Mines and Energy, Halifax, Nova Scotia, 121-140.

DREIMANIS, A. 1976. Tills: their origin and properties. *In* Glacial Till: an interdisciplinary study. *Edited by* R. F. Legget. Royal Society of Canada, Special Publication, **12**, 11-49.

FYFFE, L. R. 1982a. Taconian and Acadian structural trends in central and northern New Brunswick. *In* Major structural zones and faults of the northern Appalachians. *Edited by* P. St-Julian and J. Béland. Geological Association of Canada, Special Paper, **24**, 117-130.

---------- 1982b. Geology, Woodstock. New Brunswick Department of Natural Resources. Map Plate **85-17**.

---------- 1997. Geology of the Rollingdam area (NTS 21 G/06), Charlotte County, New Brunswick. Woodstock. New Brunswick Department of Natural Resources. Map Plate **97-31**.

FYFFE, L. R. and FRICKER, A. 1987. Tectonostatigraphic terrane analysis of New Brunswick. Maritime Sediments and Atlantic Geology, **23**, 113-122.

GADD, N. R. 1973a. Quaternary geology of southwest New Brunswick with particular reference to Fredericton area. Geological Survey of Canada, Paper **71-34**, 31 p.

---------- 1973b. Quaternary geology of Fredericton map sheet, New Brunswick. Geological Survey of Canada, Map **12-1971**.

GRANT, D. R. 1963. Pebble lithology of the tills of southeast Nova Scotia. MSc. Thesis, Dalhousie University, Halifax, Nova Scotia.

HAWKES, H. E. and WEBB, J. S. 1962. Geochemistry in Mineral Exploration. Harper and Row Publishers Incorporated, New York, 415 p.

HIND, H. Y. 1865. A preliminary report on the geology of New Brunswick, together with A special report on the distribution of the “Quebec Group” in the Province. Journal Assembly of New Brunswick, Appendix **8**, 293 p.

LEE, H. A. 1957. Surficial geology of Fredericton, York, and Sunbury counties, New Brunswick. Geological Survey of Canada, Map **24-1959**.

---------- 1962. Surficial geology of Canterbury, Woodstock, Florenceville, and Andover map-areas; York, Carleton, and Victoria counties, New Brunswick (Parts of 21 G/14, 21J/4, 21J/5, and 21J/12). Geological Survey of Canada, Topical Report, **33**, 16 p.

LYNCH, J. 1990. Provisional elemental values for eight new geochemical lake sediment and stream sediment reference materials LKSD-1, LKSD-2, LKSD-3, LKSD-4, STSD-1, STSD-2, STSD-3, STSD-4. Geostandards Newsletter, **14**, 153-167.

LYNCH, J. 1996. Provisional elemental values for four new geochemical soil and till reference materials, TILL-1, TILL-2, TILL-3 and TILL-4. Geostandards Newsletter, **20**, 277-287.

MATTHEW, G. F. 1872. On the surface geology of New Brunswick. Canadian Naturalist, New Series, **VII**, 89-107

---------- 1879. Report on the superficial geology of southern New Brunswick. Geological Survey of Canada, Report of Progress **1877-78**, Part **10**, 39 p.

PARENT, M., PARADIS, S. and DOIRON, A. 1996. Palimpsest glacial dispersal trains and their significance to drift prospecting. Journal of Geochemical Exploration, **56**, 123-140.

PARKHILL, M. A. 1994. Surficial geology and till geochemistry of the Nepisiguit Lakes (NTS 21 O/7) and California Lake (NTS 21 O/8) map areas; Gloucester, Northumberland, Resigouche, and Victoria Counties. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division. Geoscience Report **94-3**, 275 p.

POTTER, R. R., HAMILTON, J. B. and DAVIES, J. L. 1979. Geological map of New Brunswick. New Brunswick Department of Natural Resources, Map Plate **NR-1**.

PRONK, A. G. 1987. Pleistocene glacial dispersal and history in Buttle Valley, Vancouver Island, British Columbia: a feasibility study for alpine drift prospecting, Discussion. Canadian Journal of Earth Sciences, **24**, 1504-1505.

PRONK, A. G., BOBROWSKY, P.T. and PARKHILL, M. A. 1989. An interpretation of the Late Quaternary glacial flow indicators in the Baie de Chaleurs region, northern New Brunswick. Géographie Physique et Quaternaire, **43**, 179-190.

PRONK, A. G. and RUITENBERG, A. A. 1991. Applications of surficial mapping to forest management in New Brunswick. Atlantic Geology, **27**, 209-212.

RAMPTON, V. N., GAUTHIER, R. C., THIBAULT, J. and SEAMAN, A.A. 1984. Quaternary geology of New Brunswick. Geological Survey of Canada, Memoir **416**, 77 p.

ROBB, J. 1851. Notice of observations on drift striae in New Brunswick. Proceedings of the American Association for the Advancement of Science, **4**, 349-351.

ROSE, A. W., HAWKES, H. E. and WEBB, J. S. 1979. Geochemistry in Mineral Exploration. Academic Press Incorporated, London, 657 p.

RUITENBERG, A. A. 1967. Stratigraphy, structure and metallization, Piskahegan-Rolling Dam area, New Brunswick. Leidse Geologische Mededelingen, **40**, 79-120.

RUITENBERG, A. A., FYFFE, L. R., McCUTCHEON, S. R., ST. PETER, C. J., IRRINKI, R. R. and VENUGOPAL, D. V. 1977. Evolution of pre-Carboniferous tectonostratigraphic zones in the New Brunswick Appalachians. Geoscience Canada, **4**, 171-181.

RUITENBERG, A. A. and McCUTCHEON, S. R. 1982. Tungsten-molybdenum, tin, antimony deposits in New Brunswick. *In* Major Structural Zones and Faults of the Northern Appalachians. *Edited by* P. St-Julien and J. Beland. Geological Association of Canada, Special Paper, **24**, 18 p.

RUITENBERG, A. A. and McCUTCHEON, S. R. 1994. Geological compilation, correlation, and metallogeny of southern New Brunswick. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division. Current Research, Miscellaneous Report, **12**, 82-86.

SEAMAN, A. A. 1989a. Glacial striae trends in New Brunswick: a compilation. New Brunswick Department of Natural Resources and Energy, Open File Report **89-34**, 136 p.

---------- 1989b. Late Wisconsinan glaciation and deglaciation of the St. Croix Highlands area, southwestern New Brunswick. *In* Late glacial and post-glacial processes and environments in Montane and adjacent areas. Canadian Quaternary Association, CANQUA 1989, August 26-27, 1989, Edmonton, Alberta, Program and Abstracts, p. 46.

---------- 1989c. Quaternary stratigraphy; York, Sunbury, and Charlotte counties, New Brunswick. *In* Project Summaries for 1989: Fourteenth Annual Review of Activities. *Edited by* S. A. Abbott, New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Information Circular **89-2**, 44-51.

SEAMAN, A. A., BROSTER, B. E., CYNWAR, L. C., LAMOTHE, M., MILLER, R. F. and THIBAULT, J. J. 1993. Field guide to the Quaternary geology of Southwestern New Brunswick. New Brunswick Department of Natural Resources and Energy, Mineral Resources, Open File Report **93-1**, 102 p.

SHILTS, W. W. 1975. Principles of geochemical exploration for sulphide deposits using shallow samples of glacial drift. Canadian Institute of Mining and Metallurgy, Bulletin **68**, pp. 73-80.

---------- 1976. Glacial till and mineral exploration. *In* Glacial Till: an interdisciplinary study. *Edited by* R. F. Legget. Royal Society of Canada, Special Publication, **12**, 205-224.

---------- 1995. Geochemical partitioning in till. *In* Drift exploration in the Canadian Cordillera. *Edited by* P. T. Bobrowsky, S. J. Sibbick, J. M. Newell and P. F. Matysek. Mineral Resources Division, Geological Survey Branch, Paper **1995-2**, 149-164.

STEA, R. R. and FINCK, P. W. 2001. An evolutionary model of glacial dispersal and till genesis in Maritime Canada. *In* Drift Exploration in Glaciated Terrain. *Edited by* M. B. McClenaghan, P. T. Bobrowsky, G. E. M. Hall and S. J. Cook. Geological Society, London, Special Publications, **185**, 237-265.

STUMPF, A. J. 1995. Quaternary geology and dispersal patterns of the McAdam (NTS 21 G/11) map area, York County, New Brunswick. New Brunswick Department of Natural Resources and Energy, Mineral Resources, Open File Report **95-5**, 218 p.

---------- 2001. Late Quaternary ice flow, stratigraphy, and history of the Babine Lake-Bulkley River region, central British Columbia, Canada. Ph.D. Thesis, University of New Brunswick, 234 p.

WICKLUND, R. E. and LANGMAID, K. K. 1953. Soil survey of southwestern New Brunswick. Fourth Report of the New Brunswick Soil Survey, Experimental Farms Service, Canada Department of Agriculture in co-operation with the New Brunswick Department of Agriculture, Fredericton, New Brunswick, 47 p.

APPENDIX I

Sample Site Locations

Sample site locations were based on a 2km^2 grid system established by means of the UTM co-ordinate system. Letters and numbers are systematically used to represent the sample sites relative to their UTM position. This is done by assigning letters A through X to denote UTM northings and numbers 2 through 15 to denote UTM eastings, (A2 refers to the site furthest to the NW while X15 refers to the site furthest to the SE). Typically accuracy is in the range of 5 to 10 metres as GPS devices were used to pinpoint all site localities.

The letters RD refer to Rollingdam (NTS 21G/06) where the samples were collected, and the letters FD following the sample numbers denote a duplicate site (field duplicate). Where samples were collected off the grid, additional descriptors (a, b, .5) were used while multiple samples from one location are termed -1 and -2.

APPENDIX 1: Sample Site Locations

Sample ID	Mapsheet NTS#	UTM Easting (NAD27)	UTM Northing (NAD27)
RDA02	21G/06	0618361	5038444
RDA03-1	21G/06	0617821	5036927
RDA03-2	21G/06	0617821	5036927
RDA04	21G06	0618589	5035628
RDB02	21G/06	0620549	5039101
RDB03	21G/06	0619582	5036765
RBB04	21G/06	0620173	5034939
RDB05	21G/06	0619981	5032926
RDB06	21G/06	0620456	5031379
RDB13	21G/06	0621260	5016062
RDB14	21G/06	0620343	5014726
RDB15	21G/06	0619836	5013099
RDC02	21G/06	0621935	5038743
RDC03	21G/06	0622253	5036905
RDC04	21G/06	0622008	5035119
RDC05	21G/06	0622042	5032909
RDC06	21G/06	0622271	5030587
RDC07	21G/06	0622117	5029071
RDC12	21G/06	0621983	5019019
RDC13	21G/06	0622801	5017167
RDC14	21G/06	0622089	5015250
RDC15	21G/06	0621576	5013115
RDCD11	21G/06	0623199	5020871
RDD02	21G/06	0623932	5039027
RDD03	21G/06	0623671	5036553
RDD04	21G/06	0624268	5034895
RDD05	21G/06	0623855	5032946
RDD06	21G/06	0623920	5030917
RDD07	21G/06	0623856	5029174
RDD08	21G/06	0623887	5026820
RDD09	21G/06	0623597	5024689
RDD10	21G/06	0623689	5023257
RDD12	21G/06	0623854	5019394
RDD13-1	21G/06	0623995	5016777
RDD13-2	21G/06	0623995	5016777
RDD14	21G/06	0623900	5014718
RDD15	21G/06	0623845	5013147
RDE02	21G/06	0625589	5038869
RDE03	21G/06	0626184	5036847
RDE04	21G/06	0626022	5034983
RDE05	21G/06	0625370	5032328
RDE07	21G/06	0626079	5028980
RDE08	21G/06	0626052	5027078
RDE09	21G/06	0625927	5025481

APPENDIX 1: Sample Site Locations Continued

Sample ID	Mapsheet	UTM Easting	UTM Northing
	NTS#	(NAD27)	(NAD27)
RDE10	21G/06	0625947	5022817
RDE11	21G/06	0626262	5020815
RDE12	21G/06	0625737	5019476
RDE13	21G/06	0625644	5017039
RDE14	21G/06	0626045	5014936
RDE15	21G/06	0626009	5013290
RDEF06	21G/06	0627017	5030630
RDF02	21G/06	0627859	5038970
RDF03	21G/06	0627958	5037010
RDF04	21G/06	0627959	5035959
RDF05	21G/06	0628046	5033505
RDF07	21G/06	0628072	5028952
RDF08	21G/06	0628170	5026986
RDF09	21G/06	0627992	5025471
RDF10	21G/06	0628214	5023186
RDF11	21G/06	0627789	5020550
RDF12	21G/06	0628011	5019083
RDF13	21G/06	0627678	5017165
RDF14	21G/06	0627674	5014956
RDF15	21G/06	0627941	5013141
RDG02	21G/06	0629429	5038719
RDG03	21G/06	0629191	5036627
RDG04	21G/06	0630398	5035082
RDG05	21G/06	0630201	5033133
RDG06	21G/06	0630081	5031517
RDG07	21G/06	0630137	5028816
RDG08	21G/06	0630015	5027170
RDG09	21G/06	0630017	5025021
RDG10	21G/06	0629924	5022986
RDG11	21G/06	0630028	5020999
RDG12FD	21G/06	0629824	5018618
RDG13	21G/06	0630752	5017440
RDG14a	21G/06	0629909	5014723
RDG14b	21G/06	0630113	5014335
RDG15	21G/06	0630257	5013240
RDH02	21G/06	0631908	5038888
RDH03	21G/06	0632250	5037225
RDH04	21G/06	0631728	5034810
RDH05	21G/06	0631819	5033072
RDH06	21G/06	0631945	5031422
RDH07	21G/06	0632216	5028582
RDH08	21G/06	0631539	5026619
RDH09	21G/06	0632341	5024853
RDH10	21G/06	0632810	5023458
RDH11	21G/06	0632109	5020610

APPENDIX 1: Sample Site Locations Continued

Sample ID	Mapsheet	UTM Easting	UTM Northing
	NTS#	(NAD27)	(NAD27)
RDH12	21G/06	0631850	5019497
RDH13	21G/06	0632076	5016664
RDH14.5	21G/06	0631964	5013834
RDK02	21G/06	0633732	5039458
RDK03	21G/06	0633919	5037455
RDK04	21G/06	0634258	5035146
RDK05	21G/06	0634102	5032794
RDK06	21G/06	0634533	5031084
RDK07	21G/06	0633681	5029141
RDK08	21G/06	0634700	5026960
RDK09	21G/06	0633891	5025530
RDK10	21G/06	0634691	5023171
RDK11	21G/06	0633761	5020868
RDK12	21G/06	0634239	5018726
RDK13	21G/06	0634050	5016828
RDK14	21G/06	0633812	5014890
RDK15	21G/06	0634084	5013040
RDL02	21G/06	0636018	5038928
RDL03	21G/06	0635560	5036721
RDL04	21G/06	0635860	5034719
RDL05	21G/06	0636261	5032896
RDL06	21G/06	0636027	5030897
RDL07	21G/06	0635982	5028644
RDL08	21G/06	0636141	5026906
RDL09	21G/06	0635792	5024948
RDL10	21G/06	0636170	5023329
RDL11a	21G/06	0635557	5020867
RDL11b	21G/06	0635540	5020799
RDL12	21G/06	0635984	5018969
RDL13	21G/06	0635852	5016896
RDL14	21G/06	0636082	5014913
RDL15	21G/06	0635873	5013279
RDM02	21G/06	0637819	5038850
RDM03FD	21G/06	0638232	5036932
RDM04	21G/06	0637918	5035509
RDM05	21G/06	0637811	5033135
RDM06	21G/06	0637568	5031256
RDM07	21G/06	0637643	5029285
RDM08	21G/06	0637927	5026735
RDM09	21G/06	0638819	5025200
RDM10	21G/06	0637423	5022779
RDM11	21G/06	0638006	5021241
RDM12	21G/06	0637872	5018949
RDM13	21G/06	0638022	5016884

APPENDIX 1: Sample Site Locations Continued

Sample ID	Mapsheet	UTM Easting	UTM Northing
	NTS#	(NAD27)	(NAD27)
RDM14	21G/06	0637926	5014874
RDM15-1	21G/06	0638080	5013094
RDM15-2	21G/06	0638080	5013094
RDN02	21G/06	0640410	5039014
RDN03	21G/06	0640048	5037504
RDN04	21G/06	0640300	5034826
RDN05	21G/06	0639792	5032911
RDN06	21G/06	0639853	5030704
RDN07	21G/06	0639889	5029283
RDN08	21G/06	0640099	5027510
RDN09	21G/06	0640033	5025240
RDN10	21G/06	0639879	5023272
RDN11	21G/06	0639736	5020646
RDN12	21G/06	0639819	5018701
RDN13	21G/06	0639969	5016837
RDN14	21G/06	0640304	5014860
RDN15	21G/06	0639836	5012932
RDP02	21G/06	0642571	5038452
RDP03	21G/06	0642037	5036790
RDP04	21G/06	0641802	5035511
RDP05	21G/06	0641664	5032833
RDP06	21G/06	0642194	5030813
RDP07	21G/06	0642092	5028820
RDP08	21G/06	0641972	5027530
RDP09	21G/06	0642008	5024790
RDP10	21G/06	0642032	5022893
RDP11	21G/06	0641790	5021170
RDP12	21G/06	0642012	5018982
RDP13	21G/06	0641835	5017025
RDP14	21G/06	0641902	5014867
RDP15	21G/06	0641813	5013463
RDQ02	21G/06	0643868	5038335
RDQ03	21G/06	0644183	5037010
RDQ04	21G/06	0643703	5034850
RDQ05	21G/06	0643948	5033796
RDQ06	21G/06	0644391	5031008
RDQ07	21G/06	0643911	5028818
RDQ09	21G/06	0644435	5024568
RDQ10	21G/06	0643920	5022956
RDQ11	21G/06	0643827	5021072
RDQ12	21G/06	0644007	5019254
RDQ13	21G/06	0644091	5016997
RDQ14	21G/06	0643937	5015114
RDQ15	21G/06	0644325	5013198
RDR02	21G/06	0646414	5039510

APPENDIX 1: Sample Site Locations Continued

Sample ID	Mapsheet NTS#	UTM Easting (NAD27)	UTM Northing (NAD27)
RDR03	21G/06	0645698	5036606
RDR04	21G/06	0646037	5034881
RDR05	21G/06	0645669	5033478
RDR06	21G/06	0645771	5030775
RDR07	21G/06	0645927	5028824
RDR08	21G/06	0645137	5026288
RDR09	21G/06	0646115	5025197
RDR10	21G/06	0645651	5023368
RDR11	21G/06	0645436	5021124
RDR12FD	21G/06	0645853	5019498
RDR13	21G/06	0645760	5017115
RDR14	21G/06	0645823	5014764
RDR15	21G/06	0646060	5012705
RDS02	21G/06	0647712	5038664
RDS03	21G/06	0648036	5037269
RDS04	21G/06	0648232	5035068
RDS05	21G/06	0648518	5033399
RDS06	21G/06	0647621	5031162
RDS07	21G/06	0646968	5029406
RDS07.5	21G/06	0648396	5026249
RDS08	21G/06	0647715	5027729
RDS09	21G/06	0647230	5024395
RDS10	21G/06	0647742	5023170
RDS11	21G/06	0647637	5020891
RDS12FD	21G/06	0647734	5019293
RDS13	21G/06	0647250	5017061
RDS14	21G/06	0648039	5015424
RDS15	21G/06	0648371	5012905
RDT02	21G/06	0650001	5038971
RDT03	21G/06	0649917	5037274
RDT04	21G/06	0650076	5034796
RDT05	21G/06	0649871	5032548
RDT06	21G/06	0650043	5030951
RDT07	21G/06	0649920	5029267
RDT08	21G/06	0649955	5026654
RDT09	21G/06	0650015	5025408
RDT09.5	21G/06	0648888	5022979
RDT10	21G/06	0650411	5021976
RDT11	21G/06	0649693	5020655
RDT12	21G/06	0649912	5019073
RDT13	21G/06	0649995	5016876
RDT14	21G/06	0649960	5014883
RDT15	21G/06	0649734	5012781
RDV02a	21G/06	0651417	5038800
RDV02b	21G/06	0651617	5038800

APPENDIX 1: Sample Site Locations Continued

Sample ID	Mapsheet	UTM Easting	UTM Northing
	NTS#	(NAD27)	(NAD27)
RDV03FD	21G/06	0652323	5037327
RDV04	21G/06	0651881	5035293
RDV05	21G/06	0652628	5032533
RDV06	21G/06	0652117	5030901
RDV07a	21G/06	0652010	5029375
RDV07b	21G/06	0651536	5028686
RDV08	21G/06	0651826	5027002
RDV09	21G/06	0652080	5024965
RDV10	21G/06	0652096	5022869
RDV11	21G/06	0652117	5021027
RDV12	21G/06	0652152	5019061
RDV13	21G/06	0651866	5016495
RDV14	21G/06	0652121	5014872
RDV15	21G/06	0651842	5013090
RDW02	21G/06	0654247	5039308
RDW03	21G/06	0653800	5037329
RDW04	21G/06	0654223	5035274
RDW05	21G/06	0653864	5032457
RDW06	21G/06	0654069	5031048
RDW07	21G/06	0654019	5029107
RDW08	21G/06	0654018	5027479
RDW09	21G/06	0653835	5025021
RDW10	21G/06	0653868	5023267
RDW11	21G/06	0653554	5020963
RDW12	21G/06	0653957	5018999
RDW13	21G/06	0653958	5016844
RDW14	21G/06	0653160	5014317
RDW15	21G/06	0654503	5013195
RDX02	21G/06	0655841	5039060
RDX03	21G/06	0655675	5037098
RDX04	21G/06	0656045	5034878
RDX05	21G/06	0655805	5033141
RDX06	21G/06	0656168	5030881
RDX07	21G/06	0656245	5029109
RDX08	21G/06	0656504	5027493
RDX09	21G/06	0656562	5025677
RDX10a	21G/06	0655965	5022857
RDX10b	21G/06	0655669	5022841
RDX11	21G/06	0656097	5020686
RDX12-1	21G/06	0655884	5018592
RDX12-2	21G/06	0655884	5018592
RDX13	21G/06	0655980	5016961
RDX14	21G/06	0656550	5015057
RDX15	21G/06	0656185	5012786

APPENDIX II

Granulometric Analysis Data

Granulometric analysis was conducted on the <2mm fraction of all collected till samples using a modified hydrometer technique based on the hydrometer method of Bouyoucos (1962). The procedure, which requires 50 grams of dried matrix material sieved to the < 2mm fraction, is used to determine the percent sand, silt and clay in the till sample.

Summary of Methodology

1. 50g sample of the sample (<mm fraction) is dispersed in a 10% solution of Calgon® and distilled water. Calgon® is an effective dispersing agent that acts to separate individual grains within the solution.

2. The sample sits in the dispersing solution for 15 minutes and then is stirred for 5 minutes using an electric mixer.

3. At this stage the sample solution is transferred to a glass cylinder. An ASTM 152H hydrometer is placed in the liquid and distilled water added until the 1130-ml mark of the cylinder is reached.

4. The hydrometer is removed and a stopper is placed in the top of the cylinder to allow for vigorous shaking of the cylinder by hand. After the solution has been shaken for 15 - 20 seconds the cylinder is gently set down and time recorded.

5. At this point a calibrated ASTM 152H hydrometer is inserted gently in the solution and 2-3 drops of Amyl alcohol added (used to break surface tension).

6. At exactly 40 seconds and again at 2 hours a hydrometer reading and temperature reading is taken. The percent sand in the sample is equal to 100 minus the value obtained from the hydrometer reading at 40 seconds while the percent clay corresponds to twice the value obtained from the 2-hour reading. Percent silt is of course equal to percent sand minus percent clay.

7. Appropriate temperature and hydrometer calibration corrections are applied if necessary.

APPENDIX 2: Granulometric Data

Sample	Till Type	% Sand	%Silt	%Clay	Silt/Clay
RDA02	bT	52	41	7	5.9
RDA03C1	aT	61	35	4	8.8
RDA03C2	bT	60	35	5	7.0
RDA04	aT	52	36	12	3.0
RDB02	bT	50	38	12	3.2
RDB03	bT	47	45	8	5.6
RBB04	bT	58	38	4	9.5
RDB05	bT	60	37	3	12.3
RDB06	bT	54	40	6	6.7
RDB13	bT	49	40	11	3.6
RDB14	bT	47	46	7	6.6
RDB15	bT	48	34	18	1.9
RDC02	aT	53	40	7	5.7
RDC03	bT	50	29	21	1.4
RDC04	bT	53	40	7	5.7
RDC05	bT	48	41	11	3.7
RDC06	bT	49	39	12	3.3
RDC07	aT	67	29	4	7.3
RDC12	bT	44	39	17	2.3
RDC13	bT	52	41	7	5.9
RDC14	bT	41	45	14	3.2
RDC15	bT	33	57	10	5.7
RDCD11	bT	43	34	23	1.5
RDD02	aT	59	36	5	7.2
RDD03	bT	24	62	14	4.4
RDD04	bT	56	27	17	1.6
RDD05	aT	67	28	5	5.6
RDD06	bT	50	30	20	1.5
RDD07	bT	43	36	21	1.7
RDD08	aT	70	26	4	6.5
RDD09	bT	48	39	13	3.0
RDD10	bT	49	39	12	3.3
RDD12	bT	53	38	9	4.2
RDD13C1	bT	46	43	11	3.9
RDD13C2	bT	41	34	25	1.4
RDD14	bT	48	43	9	4.8
RDD15	bT	15	40	45	0.9
RDE02	bT	47	46	7	6.6
RDE03	bT	61	34	5	6.8
RDE04	bT	58	33	9	3.7
RDE05	bT	43	36	21	1.7
RDE07	bT	52	36	12	3.0
RDE08	bT	48	40	12	3.3
RDE09	bT	47	40	13	3.1
RDE10	bT	36	56	8	7.0
RDE11	bT	47	36	17	2.1

APPENDIX 2: Granulometric Data (continued)

Sample	Till Type	% Sand	%Silt	%Clay	Silt/Clay
RDE12	aT	73	23	4	5.8
RDE13	bT	43	46	11	4.2
RDE14	bT	53	33	14	2.4
RDE15	bT	45	38	17	2.2
RDEF06	bT	47	38	15	2.5
RDF02	aT	80	18	2	9.0
RDF03	bT	58	38	4	9.5
RDF04	bT	58	41	1	41.0
RDF05	bT	59	33	8	4.1
RDF07	bT	55	37	8	4.6
RDF08	bT	40	45	15	3.0
RDF09	bT	51	38	11	3.5
RDF10	bT	54	41	5	8.2
RDF11	aT	56	31	13	2.4
RDF12	bT	39	55	6	9.2
RDF13	aT	55	38	7	5.4
RDF14	bT	44	44	12	3.7
RDF15	bT	52	36	12	3.0
RDG02	aT	57	33	10	3.3
RDG03	bT	50	39	11	3.5
RDG04	bT	46	41	13	3.2
RDG05	bT?	57	34	9	3.8
RDG06	aT	64	32	4	8.0
RDG07	bT?	59	34	7	4.9
RDG08	bT	70	26	4	6.5
RDG09	bT	56	33	11	3.0
RDG10	aT	57	38	5	7.6
RDG11	aT	53	43	4	10.8
RDG12	bT	37	34	29	1.2
RDG12FD	bT	42	37	21	1.8
RDG13	bT	43	37	20	1.9
RDG14	aT	61	34	5	6.8
RDG14-1	bT	52	36	12	3.0
RDG15	aT	61	30	9	3.3
RDH02	bT	59	34	7	4.9
RDH03	aT	65	32	3	10.7
RDH04	aT	87	12	1	12.0
RDH05	bT?	85	12	3	4.0
RDH06	bT	69	25	6	4.2
RDH07	bT	53	41	6	6.8
RDH08	bT	49	45	6	7.5
RDH09	bT	65	30	5	6.0
RDH10	?	44	47	9	5.2
RDH11	bT	72	26	2	13.0
RDH12	bT	54	39	7	5.6
RDH13	bT	41	38	21	1.8

APPENDIX 2: Granulometric Data (continued)

Sample	Till Type	% Sand	%Silt	%Clay	Silt/Clay
RDH14.5	bT	52	37	11	3.4
RDK02	bT	57	36	7	5.1
RDK03	bT	70	28	2	14.0
RDK04	aT	59	33	8	4.1
RDK05	bT	60	35	5	7.0
RDK06	aT	65	34	1	34.0
RDK07	aT	57	36	7	5.1
RDK08	bT	54	35	11	3.2
RDK09	bT	49	42	9	4.7
RDK10	bT	53	40	7	5.7
RDK11	bT	56	29	15	1.9
RDK12	aT?	44	43	13	3.3
RDK13	bT	54	41	5	8.2
RDK14	bT?	64	29	7	4.1
RDK15	bT	55	35	10	3.5
RDL02	aT	73	24	3	8.0
RDL03	bT	65	31	4	7.8
RDL04	bT	61	34	5	6.8
RDL05	bT	46	43	11	3.9
RDL06	aT	69	30	1	30.0
RDL07	bT	68	29	3	9.7
RDL08	bT	55	35	10	3.5
RDL09	bT	50	37	13	2.8
RDL10	aT	67	28	5	5.6
RDL11	aT	82	17	1	17.0
RDL11-1	aT	71	27	2	13.5
RDL12	aT	69	29	2	14.5
RDL13	aT	55	37	8	4.6
RDL14	bT	55	34	11	3.1
RDL15	bT	45	31	24	1.3
RDM02	aT	65	32	3	10.7
RDM03	bT	63	30	7	4.3
RDM03FD	bT	66	29	5	5.8
RDM04	bT	68	28	4	7.0
RDM05	bT	55	38	7	5.4
RDM06	bT	73	26	1	26.0
RDM07	bT	59	35	6	5.8
RDM08	bT	59	34	7	4.9
RDM09	bT	51	42	7	6.0
RDM10	bT	55	35	10	3.5
RDM11	aT	69	28	3	9.3
RDM12	bT	59	37	4	9.3
RDM13	bT	49	33	18	1.8
RDM14	bT?	49	36	15	2.4
RDM15C1	aT	65	26	9	2.9
RDM15C2	bT	48	31	21	1.5

APPENDIX 2: Granulometric Data (continued)

Sample	Till Type	% Sand	%Silt	%Clay	Silt/Clay
RDN02	bT	64	33	3	11.0
RDN03	aT	65	34	1	34.0
RDN04	bT	74	25	1	25.0
RDN05	bT	67	31	2	15.5
RDN06	bT	49	43	8	5.4
RDN07	aT	71	28	1	28.0
RDN08	aT	62	36	2	18.0
RDN09	bT	54	35	11	3.2
RDN10	bT	58	35	7	5.0
RDN11	bT?	72	25	3	8.3
RDN12	bT	46	39	15	2.6
RDN13	aT?	61	35	4	8.8
RDN14	bT	64	32	4	8.0
RDN15	bT	66	29	5	5.8
RDP02	bT	60	33	7	4.7
RDP03	bT	56	33	11	3.0
RDP04	bT	64	31	5	6.2
RDP05	aT	72	23	5	4.6
RDP06	bT	57	34	9	3.8
RDP07	bT	52	35	13	2.7
RDP08	bT	54	34	12	2.8
RDP09	aT	70	27	3	9.0
RDP10	bT	49	36	15	2.4
RDP11	bT	49	36	15	2.4
RDP12	bT	39	37	24	1.5
RDP13	bT	64	31	5	6.2
RDP14	aT	69	27	4	6.8
RDP15	bT	61	34	5	6.8
RDQ02	bT	57	32	11	2.9
RDQ03	bT	52	33	15	2.2
RDQ04	bT	57	32	11	2.9
RDQ05	bT	66	31	3	10.3
RDQ06	bT	53	38	9	4.2
RDQ08	aT	66	29	5	5.8
RDQ09	bT	63	33	4	8.3
RDQ10	bT	67	28	5	5.6
RDQ11	bT	70	27	3	9.0
RDQ12	bT	41	43	16	2.7
RDQ13	bT?	74	24	2	12.0
RDQ14	bT	58	35	7	5.0
RDQ15	bT	52	39	9	4.3
RDR02	bT	53	37	10	3.7
RDR03	bT	55	36	9	4.0
RDR04	bT	67	27	6	4.5
RDR05	bT?	57	35	8	4.4
RDR06	bT?	53	40	7	5.7

APPENDIX 2: Granulometric Data (continued)

Sample	Till Type	% Sand	%Silt	%Clay	Silt/Clay
RDR07	bT	54	30	16	1.9
RDR08	bT	60	35	5	7.0
RDR09	bT?	65	30	5	6.0
RDR10	bT	50	37	13	2.8
RDR11	bT	55	39	6	6.5
RDR12	bT	54	37	9	4.1
RDR12FD	bT	51	36	13	2.8
RDR13	bT	48	40	12	3.3
RDR14	aTv	68	26	6	4.3
RDR15	bt	26	48	26	1.8
RDS02	bT	50	40	10	4.0
RDS03	bT	58	35	7	5.0
RDS04	bT	57	33	10	3.3
RDS05	aT?	70	25	5	5.0
RDS06	bT	50	38	12	3.2
RDS07	bT	57	33	10	3.3
RDS07.5	bT	37	51	12	4.3
RDS08	bT	46	39	15	2.6
RDS09	bT	54	36	10	3.6
RDS10	bT	44	47	9	5.2
RDS11	bT	45	41	14	2.9
RDS12	bT	50	35	15	2.3
RDS12FD	bT	48	35	17	2.1
RDS13	bT	44	42	14	3.0
RDS14	bT?	26	61	13	4.7
RDS15	bT	38	35	27	1.3
RDT02	bT	59	28	13	2.2
RDT03	bT	59	32	9	3.6
RDT04	aT	68	27	5	5.4
RDT05	bT	55	32	13	2.5
RDT06	bT	51	34	15	2.3
RDT07	aT	53	40	7	5.7
RDT08	aT	68	26	6	4.3
RDT09	bT	64	32	4	8.0
RDT9.5	bT	48	41	11	3.7
RDT10	bT	58	34	8	4.3
RDT11	bT	63	32	5	6.4
RDT12	bT	67	23	10	2.3
RDT13	bT	58	33	9	3.7
RDT14	bT	48	35	17	2.1
RDT15	bT	47	38	15	2.5
RDV02	bT	63	30	7	4.3
RDV02-1	bT	48	41	11	3.7
RDV03	bT	51	29	20	1.5
RDV03FD	bT	50	29	21	1.4
RDV04	bT	58	29	13	2.2

APPENDIX 2: Granulometric Data (continued)

Sample	Till Type	% Sand	%Silt	%Clay	Silt/Clay
RDV05	bT	45	43	12	3.6
RDV06	bT	54	30	16	1.9
RDV07	aT?	69	25	6	4.2
RDV07-2	bT	52	32	16	2.0
RDV08	bT	51	28	21	1.3
RDV09	bT	53	40	7	5.7
RDV10	aT	56	39	5	7.8
RDV11	aT?	54	37	9	4.1
RDV12	bT	67	29	4	7.3
RDV13	bT	45	40	15	2.7
RDV14	bT	46	41	13	3.2
RDV15	bT	62	32	6	5.3
RDW02	bT	48	37	15	2.5
RDW03	bT	67	25	8	3.1
RDW04	bT	56	35	9	3.9
RDW05	bT	64	32	4	8.0
RDW06	bT	50	30	20	1.5
RDW07	aT	71	27	2	13.5
RDW08	bT?	52	35	13	2.7
RDW09	bT	52	35	13	2.7
RDW10	bT	58	35	7	5.0
RDW11	bT	49	33	18	1.8
RDW12	bT	54	32	14	2.3
RDW13	bT	48	39	13	3.0
RDW14	bT	52	41	7	5.9
RDW15	bT	58	33	9	3.7
RDX02	bT	57	34	9	3.8
RDX03	bT	55	32	13	2.5
RDX04	bT?	67	24	9	2.7
RDX05	bT?	49	36	15	2.4
RDX06	bT	59	32	9	3.6
RDX07	bT	49	31	20	1.6
RDX08	bT	46	33	21	1.6
RDX09	aT	71	21	8	2.6
RDX10	aT	78	20	2	10.0
RDX10-1	aT	62	34	4	8.5
RDX11	bT	45	37	18	2.1
RDX12	aT?	43	50	7	7.1
RDX12-1	aT?	48	44	8	5.5
RDX13	bT	42	45	13	3.5
RDX14	bT	50	35	15	2.3
RDX15	bT	59	36	5	7.2

APPENDIX 2: Granulometric Data (continued)

	% Sand	%Silt	%Clay	Silt/Clay
Statistics: All Sample Sites				
Max	87	62	45	41
Min	15	12	1	0.9
Mean	55.5	34.8	9.7	5.6
St. Dev.	10.2	6.8	6.0	5.2
Statistics: Basal Till Population				
Max	85	62	45	41
Min	15	12	1	0.9
Mean	53.3	35.9	10.9	4.7
St. Dev.	9.3	6.4	6.0	4.1
Statistics: Ablation Till Population				
Max	87	50	13	34
Min	43	12	1	2.4
Mean	64.1	30.9	5.1	9.0
St. Dev.	8.9	7.2	3.0	7.3

APPENDIX III

Summary of Lithological Analysis

The clast component of 272 till samples was analyzed on the basis of lithology. Over twenty distinct clast lithologies were noted but only a summary of the results are presented here (see Chapter 5.0, section 5.3, for contour plots of specific clast lithologies showing significant dispersal patterns). Contour plots for clast lithologies showing only limited dispersal or an almost homogeneous areal distribution are presented at the end of this appendix.

Note that these results are presented as concentrations (percents) of the various clast types relative to the total clast count. Typically, till samples contained an average of 75 clasts ranging in diameter from 2 cm to 10 cm.

Sample Site	# of clasts (n)	Clastic Seds %	Intrusive Lithologies			Extrusive Lithologies				Quartz %	Conglom-erate %	Red Seds %
			%	Granitic %	Gabbroic %	%	Mafic %	M-F %	Felsic %			
RDA02	69	81.2	10.1	7.2	2.9	8.7	0.0	0.0	8.7	0.0	0.0	1.4
RDA03	94	90.4	7.4	7.4	0.0	1.1	1.1	0.0	0.0	1.1	2.1	1.1
RDA04	74	77.0	6.8	4.1	2.7	14.9	2.7	0.0	12.2	1.4	2.7	1.4
RDB02	45	95.6	4.4	4.4	0.0	0.0	0.0	0.0	0.0	0.0	6.7	2.2
RDB03	80	88.8	2.5	1.3	1.3	6.3	2.5	0.0	3.8	2.5	3.8	0.0
RBB04	20	80.0	5.0	0.0	5.0	10.0	0.0	0.0	10.0	5.0	5.0	5.0
RDB05	47	74.5	14.9	12.8	2.1	2.1	0.0	0.0	2.1	8.5	6.4	0.0
RDB06	63	96.8	1.6	1.6	0.0	1.6	0.0	0.0	1.6	0.0	3.2	1.6
RDB13	76	92.1	2.6	2.6	0.0	3.9	0.0	0.0	3.9	1.3	0.0	1.3
RDB14	62	93.5	3.2	3.2	0.0	1.6	0.0	0.0	1.6	1.6	0.0	0.0
RDB15	64	84.4	9.4	9.4	0.0	3.1	0.0	0.0	3.1	3.1	1.6	0.0
RDC02	63	92.1	3.2	3.2	0.0	4.8	1.6	0.0	3.2	0.0	3.2	1.6
RDC03	56	71.4	8.9	8.9	0.0	16.1	10.7	1.8	3.6	3.6	7.1	0.0
RDC04	51	80.4	9.8	7.8	2.0	7.8	0.0	0.0	7.8	2.0	0.0	2.0
RDC05	66	89.4	3.0	3.0	0.0	0.0	0.0	0.0	0.0	7.6	0.0	0.0
RDC06	56	85.7	10.7	8.9	1.8	0.0	0.0	0.0	0.0	3.6	1.8	0.0
RDC07	130	89.2	6.2	6.2	0.0	3.1	0.8	0.0	2.3	1.5	0.8	0.8
RDC12	36	75.0	11.1	8.3	2.8	11.1	2.8	0.0	8.3	2.8	2.8	0.0
RDC13	64	84.4	1.6	1.6	0.0	6.3	3.1	0.0	3.1	7.8	0.0	0.0
RDC14	76	92.1	2.6	2.6	0.0	5.3	5.3	0.0	0.0	0.0	0.0	0.0
RDC15	49	71.4	14.3	6.1	8.2	10.2	2.0	0.0	8.2	4.1	0.0	0.0
RDCD11	63	85.7	7.9	7.9	0.0	1.6	1.6	0.0	0.0	4.8	0.0	1.6
RDD02	61	73.8	19.7	19.7	0.0	3.3	0.0	0.0	3.3	1.6	0.0	0.0
RDD03	69	87.0	10.1	8.7	1.4	1.4	0.0	0.0	1.4	1.4	0.0	0.0
RDD04	48	81.3	6.3	6.3	0.0	12.5	0.0	0.0	12.5	0.0	10.4	4.2
RDD05	57	87.7	7.0	7.0	0.0	3.5	0.0	0.0	3.5	1.8	0.0	0.0
RDD06	58	86.2	12.1	8.6	3.4	1.7	0.0	0.0	1.7	0.0	6.9	5.2
RDD07	47	70.2	17.0	14.9	2.1	10.6	0.0	2.1	8.5	2.1	0.0	0.0
RDD08	50	80.0	10.0	6.0	4.0	10.0	6.0	2.0	2.0	0.0	0.0	0.0
RDD09	50	74.0	12.0	4.0	8.0	6.0	6.0	0.0	0.0	8.0	0.0	0.0
RDD10	44	79.5	15.9	6.8	9.1	0.0	0.0	0.0	0.0	4.5	0.0	0.0
RDD12	71	93.0	0.0	0.0	0.0	2.8	0.0	0.0	2.8	4.2	1.4	1.4
RDD13	64	89.1	4.7	1.6	3.1	3.1	1.6	0.0	1.6	3.1	1.6	0.0
RDD14	63	92.1	3.2	1.6	1.6	1.6	0.0	0.0	1.6	3.2	3.2	1.6
RDD15	5	80.0	0.0	0.0	0.0	20.0	0.0	0.0	20.0	0.0	0.0	0.0
RDE02	73	98.6	0.0	0.0	0.0	1.4	0.0	0.0	1.4	0.0	6.8	19.2
RDE03	33	78.8	9.1	6.1	3.0	9.1	9.1	0.0	0.0	3.0	0.0	0.0
RDE04	46	89.1	6.5	2.2	4.3	4.3	0.0	0.0	4.3	0.0	0.0	0.0
RDE05	58	98.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0
RDE07	76	98.7	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
RDE08	59	83.1	13.6	6.8	6.8	3.4	0.0	0.0	3.4	0.0	3.4	0.0
RDE09	51	80.4	9.8	7.8	2.0	7.8	0.0	0.0	7.8	2.0	0.0	0.0
RDE10	38	78.9	13.2	10.5	2.6	0.0	0.0	0.0	0.0	7.9	0.0	0.0
RDE11	59	86.4	10.2	6.8	3.4	3.4	0.0	0.0	3.4	0.0	0.0	0.0
RDE12	63	88.9	9.5	6.3	3.2	1.6	0.0	1.6	0.0	0.0	0.0	0.0

Sample Site	# of clasts (n)	Clastic Seds %	Intrusive Lithologies			Extrusive Lithologies				Quartz %	Conglom-erate %	Red Seds %
			%	Granitic %	Gabbroic %	%	Mafic %	M-F %	Felsic %			
RDE13	55	89.1	7.3	5.5	1.8	3.6	0.0	0.0	3.6	0.0	0.0	0.0
RDE14	42	97.6	0.0	0.0	0.0	2.4	0.0	0.0	2.4	0.0	0.0	0.0
RDE15	71	85.9	7.0	5.6	1.4	0.0	0.0	0.0	0.0	7.0	0.0	0.0
RDEF06	53	88.7	1.9	0.0	1.9	7.5	1.9	1.9	3.8	1.9	7.5	1.9
RDF02	53	75.5	13.2	11.3	1.9	5.7	0.0	0.0	5.7	5.7	0.0	3.8
RDF03	80	77.5	5.0	3.8	1.3	2.5	0.0	0.0	2.5	15.0	0.0	1.3
RDF04	57	87.7	3.5	3.5	0.0	1.8	1.8	0.0	0.0	7.0	1.8	1.8
RDF05	67	74.6	16.4	16.4	0.0	4.5	0.0	0.0	4.5	4.5	1.5	3.0
RDF07	83	86.7	4.8	4.8	0.0	1.2	0.0	0.0	1.2	7.2	0.0	1.2
RDF08	59	71.2	18.6	13.6	5.1	6.8	0.0	0.0	6.8	3.4	0.0	1.7
RDF09	63	90.5	6.3	6.3	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
RDF10	102	89.2	2.9	2.9	0.0	0.0	0.0	0.0	0.0	7.8	1.0	0.0
RDF11	81	93.8	3.7	2.5	1.2	2.5	0.0	0.0	2.5	0.0	0.0	0.0
RDF12	47	78.7	12.8	12.8	0.0	2.1	0.0	0.0	2.1	6.4	0.0	0.0
RDF13	53	92.5	1.9	1.9	0.0	3.8	1.9	0.0	1.9	1.9	0.0	0.0
RDF14	52	84.6	0.0	0.0	0.0	7.7	0.0	0.0	7.7	7.7	0.0	0.0
RDF15	69	89.9	7.2	7.2	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0
RDG02	49	79.6	20.4	20.4	0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.1
RDG03	47	78.7	17.0	14.9	2.1	0.0	0.0	0.0	0.0	4.3	2.1	0.0
RDG04	33	87.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.1	0.0	0.0
RDG05	64	92.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	1.6	0.0
RDG06	85	84.7	9.4	7.1	2.4	4.7	0.0	0.0	4.7	1.2	0.0	0.0
RDG07	77	89.6	7.8	7.8	0.0	1.3	0.0	0.0	1.3	1.3	1.3	5.2
RDG08	99	79.8	14.1	10.1	4.0	2.0	0.0	0.0	2.0	4.0	2.0	0.0
RDG09	54	96.3	3.7	0.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RDG10	68	86.8	7.4	7.4	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0
RDG11	72	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RDG12FD	28	78.6	17.9	14.3	3.6	3.6	0.0	0.0	3.6	0.0	0.0	0.0
RDG13	41	87.8	9.8	9.8	0.0	0.0	0.0	0.0	0.0	2.4	2.4	0.0
RDG14	46	91.3	8.7	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RDG14-1	17	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RDG15	54	85.2	11.1	9.3	1.9	3.7	0.0	0.0	3.7	0.0	0.0	1.9
RDH02	55	90.9	1.8	0.0	1.8	0.0	0.0	0.0	0.0	7.3	1.8	0.0
RDH03	51	90.2	5.9	3.9	2.0	0.0	0.0	0.0	0.0	3.9	2.0	7.8
RDH04	185	85.4	13.5	11.4	2.2	0.0	0.0	0.0	0.0	1.1	0.0	0.0
RDH05	61	85.2	11.5	6.6	4.9	1.6	0.0	0.0	1.6	1.6	3.3	0.0
RDH06	79	97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
RDH07	85	95.3	2.4	2.4	0.0	1.2	0.0	0.0	1.2	1.2	0.0	0.0
RDH08	77	96.1	0.0	0.0	0.0	1.3	0.0	0.0	1.3	2.6	0.0	0.0
RDH09	67	92.5	4.5	1.5	3.0	0.0	0.0	0.0	0.0	3.0	1.5	4.5
RDH10	75	93.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0
RDH11	77	89.6	9.1	9.1	0.0	1.3	0.0	1.3	0.0	0.0	0.0	0.0
RDH12	40	82.5	12.5	10.0	2.5	0.0	0.0	0.0	0.0	5.0	0.0	0.0
RDH13	66	86.4	10.6	7.6	3.0	0.0	0.0	0.0	0.0	3.0	0.0	1.5
RDH14.5	39	87.2	10.3	10.3	0.0	0.0	0.0	0.0	0.0	2.6	2.6	0.0

Sample Site	# of clasts (n)	Clastic Seds %	Intrusive Lithologies			Extrusive Lithologies				Quartz %	Conglom-erate %	Red Seds %
			%	Granitic %	Gabbroic %	%	Mafic %	M-F %	Felsic %			
RDK02	57	87.7	7.0	7.0	0.0	1.8	0.0	0.0	1.8	3.5	0.0	0.0
RDK03	36	80.6	16.7	11.1	5.6	0.0	0.0	0.0	0.0	2.8	0.0	0.0
RDK04	67	94.0	3.0	3.0	0.0	3.0	1.5	0.0	1.5	0.0	0.0	0.0
RDK05	41	92.7	4.9	4.9	0.0	2.4	0.0	0.0	2.4	0.0	0.0	0.0
RDK06	32	93.8	3.1	3.1	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0
RDK07	77	89.6	2.6	1.3	1.3	1.3	1.3	0.0	0.0	6.5	1.3	1.3
RDK08	72	90.3	5.6	5.6	0.0	1.4	0.0	0.0	1.4	2.8	1.4	0.0
RDK09	67	95.5	1.5	1.5	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
RDK10	53	81.1	9.4	7.5	1.9	3.8	1.9	0.0	1.9	5.7	0.0	0.0
RDK11	28	78.6	3.6	3.6	0.0	10.7	3.6	0.0	7.1	7.1	3.6	0.0
RDK12	84	84.5	1.2	1.2	0.0	1.2	0.0	0.0	1.2	13.1	0.0	0.0
RDK13	63	98.4	0.0	0.0	0.0	1.6	0.0	0.0	1.6	0.0	0.0	0.0
RDK14	50	88.0	10.0	10.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0
RDK15	63	82.5	6.3	6.3	0.0	6.3	4.8	0.0	1.6	3.2	0.0	0.0
RDL02	45	93.3	4.4	4.4	0.0	0.0	0.0	0.0	0.0	2.2	0.0	2.2
RDL03	88	87.5	6.8	4.5	2.3	2.3	0.0	1.1	1.1	3.4	0.0	0.0
RDL04	72	88.9	4.2	2.8	1.4	0.0	0.0	0.0	0.0	6.9	0.0	0.0
RDL05	99	97.0	0.0	0.0	0.0	2.0	1.0	0.0	1.0	1.0	0.0	0.0
RDL06	81	93.8	3.7	3.7	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
RDL07	40	87.5	5.0	5.0	0.0	0.0	0.0	0.0	0.0	7.5	2.5	10.0
RDL08	51	88.2	5.9	3.9	2.0	3.9	0.0	0.0	3.9	2.0	3.9	3.9
RDL09	62	91.9	6.5	6.5	0.0	1.6	1.6	0.0	0.0	0.0	0.0	0.0
RDL10	74	82.4	9.5	5.4	4.1	2.7	0.0	0.0	2.7	5.4	1.4	0.0
RDL11	64	85.9	7.8	7.8	0.0	1.6	0.0	0.0	1.6	4.7	0.0	0.0
RDL12	83	92.8	2.4	2.4	0.0	1.2	0.0	0.0	1.2	3.6	0.0	0.0
RDL13	44	97.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0
RDL14	48	91.7	6.3	6.3	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
RDL15	61	70.5	27.9	24.6	3.3	1.6	0.0	0.0	1.6	0.0	0.0	0.0
RDM02	61	88.5	6.6	6.6	0.0	1.6	1.6	0.0	0.0	3.3	1.6	3.3
RDM03FD	106	92.5	0.9	0.9	0.0	3.8	0.0	0.0	3.8	2.8	0.9	0.0
RDM04	71	90.1	5.6	5.6	0.0	1.4	0.0	0.0	1.4	2.8	2.8	1.4
RDM05	53	84.9	3.8	3.8	0.0	5.7	0.0	0.0	5.7	5.7	0.0	0.0
RDM06	63	85.7	9.5	7.9	1.6	3.2	3.2	0.0	0.0	1.6	3.2	3.2
RDM07	71	94.4	0.0	0.0	0.0	1.4	0.0	0.0	1.4	4.2	0.0	0.0
RDM08	67	89.6	9.0	9.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	1.5
RDM09	68	95.6	4.4	1.5	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RDM10	54	87.0	1.9	1.9	0.0	5.6	1.9	0.0	3.7	5.6	0.0	0.0
RDM11	84	91.7	4.8	4.8	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
RDM12	125	93.3	4.4	4.4	0.0	0.7	0.0	0.7	0.0	1.5	0.0	0.0
RDM13	73	83.6	8.2	6.8	1.4	4.1	0.0	0.0	4.1	4.1	1.4	0.0
RDM14	77	93.5	2.6	2.6	0.0	2.6	2.6	0.0	0.0	1.3	0.0	0.0
RDM15C2	33	81.8	12.1	12.1	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0
RDN02	40	87.5	10.0	7.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0	0.0
RDN03	46	87.0	8.7	8.7	0.0	2.2	0.0	0.0	2.2	2.2	0.0	0.0
RDN04	57	87.7	7.0	7.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0

Sample Site	# of clasts (n)	Clastic Seds %	Intrusive Lithologies			Extrusive Lithologies				Quartz %	Conglom-erate %	Red Seds %
			%	Granitic %	Gabbroic %	%	Mafic %	M-F %	Felsic %			
RDN05	90	94.4	5.6	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1
RDN06	54	88.9	3.7	3.7	0.0	3.7	0.0	0.0	3.7	3.7	0.0	0.0
RDN07	52	88.5	5.8	5.8	0.0	1.9	0.0	0.0	1.9	3.8	1.9	1.9
RDN08	69	82.6	8.7	7.2	1.4	5.8	0.0	0.0	5.8	2.9	0.0	0.0
RDN09	49	89.8	6.1	4.1	2.0	2.0	0.0	0.0	2.0	2.0	0.0	4.1
RDN10	82	92.7	0.0	0.0	0.0	4.9	0.0	0.0	4.9	2.4	0.0	0.0
RDN11	55	80.0	7.3	7.3	0.0	9.1	1.8	0.0	7.3	3.6	0.0	0.0
RDN12	55	90.9	1.8	1.8	0.0	0.0	0.0	0.0	0.0	7.3	0.0	0.0
RDN13	58	0.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RDN14	74	59.5	31.1	31.1	0.0	2.7	0.0	0.0	2.7	6.8	0.0	0.0
RDN15	38	47.4	47.4	47.4	0.0	2.6	0.0	0.0	2.6	2.6	0.0	0.0
RDP02	69	85.5	7.2	5.8	1.4	1.4	0.0	0.0	1.4	5.8	0.0	0.0
RDP03	46	82.6	13.0	10.9	2.2	2.2	2.2	0.0	0.0	2.2	0.0	0.0
RDP04	53	81.1	11.3	11.3	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0
RDP05	72	88.9	5.6	5.6	0.0	4.2	1.4	0.0	2.8	1.4	0.0	0.0
RDP06	83	92.8	3.6	3.6	0.0	0.0	0.0	0.0	0.0	3.6	0.0	9.6
RDP07	52	92.3	1.9	1.9	0.0	0.0	0.0	0.0	0.0	5.8	1.9	0.0
RDP08	58	81.0	15.5	12.1	3.4	1.7	0.0	0.0	1.7	1.7	3.4	1.7
RDP09	56	80.4	10.7	8.9	1.8	3.6	0.0	0.0	3.6	5.4	0.0	1.8
RDP10	66	93.9	4.5	3.0	1.5	1.5	1.5	0.0	0.0	0.0	0.0	0.0
RDP11	64	93.8	0.0	0.0	0.0	4.7	0.0	0.0	4.7	1.6	3.1	0.0
RDP12	73	86.3	5.5	1.4	4.1	4.1	0.0	0.0	4.1	4.1	1.4	0.0
RDP13	47	95.7	2.1	2.1	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
RDP14	78	71.8	21.8	21.8	0.0	5.1	0.0	0.0	5.1	1.3	1.3	2.6
RDP15	76	80.3	13.2	9.2	3.9	3.9	0.0	0.0	3.9	2.6	2.6	0.0
RDQ02	54	77.8	18.5	18.5	0.0	1.9	0.0	0.0	1.9	1.9	5.6	5.6
RDQ03	41	85.4	9.8	9.8	0.0	0.0	0.0	0.0	0.0	4.9	2.4	0.0
RDQ04	121	92.6	2.5	1.7	0.8	3.3	0.8	0.0	2.5	1.7	0.0	0.8
RDQ05	95	92.6	6.3	6.3	0.0	1.1	0.0	0.0	1.1	0.0	1.1	0.0
RDQ06	81	88.9	2.5	2.5	0.0	0.0	0.0	0.0	0.0	8.6	0.0	0.0
RDQ07	41	75.6	4.9	4.9	0.0	2.4	0.0	0.0	2.4	17.1	0.0	0.0
RDQ09	64	82.8	4.7	3.1	1.6	4.7	1.6	0.0	3.1	7.8	0.0	0.0
RDQ10	72	97.2	0.0	0.0	0.0	1.4	1.4	0.0	0.0	1.4	0.0	0.0
RDQ11	35	80.0	8.6	8.6	0.0	2.9	0.0	0.0	2.9	8.6	0.0	0.0
RDQ12	52	65.4	15.4	13.5	1.9	13.5	0.0	0.0	13.5	5.8	0.0	1.9
RDQ13	83	90.4	3.6	3.6	0.0	6.0	0.0	0.0	6.0	0.0	0.0	0.0
RDQ14	33	84.8	12.1	9.1	3.0	3.0	0.0	0.0	3.0	0.0	0.0	0.0
RDQ15	85	82.4	10.6	8.2	2.4	4.7	0.0	0.0	4.7	2.4	0.0	0.0
RDR02	60	73.3	18.3	15.0	3.3	5.0	3.3	0.0	1.7	3.3	0.0	11.7
RDR03	63	79.4	17.5	17.5	0.0	3.2	3.2	0.0	0.0	0.0	0.0	1.6
RDR04	80	90.0	0.0	0.0	0.0	3.8	1.3	0.0	2.5	6.3	1.3	1.3
RDR05	71	91.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
RDR06	65	84.6	1.5	1.5	0.0	3.1	1.5	0.0	1.5	10.8	0.0	0.0
RDR07	47	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RDR08	89	88.8	1.1	1.1	0.0	5.6	0.0	0.0	5.6	4.5	0.0	0.0

Sample Site	# of clasts (n)	Clastic Seds %	Intrusive Lithologies			Extrusive Lithologies				Quartz %	Conglom-erate %	Red Seds %
			%	Granitic %	Gabbroic %	%	Mafic %	M-F %	Felsic %			
RDR09	96	91.7	2.1	1.0	1.0	1.0	1.0	0.0	0.0	5.2	0.0	0.0
RDR10	41	78.0	12.2	2.4	9.8	7.3	4.9	0.0	2.4	2.4	0.0	0.0
RDR11	36	83.3	2.8	2.8	0.0	11.1	8.3	2.8	0.0	2.8	0.0	0.0
RDR12FD	60	76.7	6.7	6.7	0.0	6.7	0.0	0.0	6.7	10.0	0.0	0.0
RDR13	43	81.4	9.3	7.0	2.3	9.3	0.0	0.0	9.3	0.0	2.3	0.0
RDR14	66	93.9	1.5	0.0	1.5	4.5	3.0	0.0	1.5	0.0	0.0	0.0
RDR15	76	98.7	0.0	0.0	0.0	1.3	1.3	0.0	0.0	0.0	0.0	0.0
RDS02	56	87.5	7.1	7.1	0.0	5.4	1.8	0.0	3.6	0.0	0.0	8.9
RDS03	49	63.3	18.4	14.3	4.1	8.2	6.1	0.0	2.0	10.2	6.1	18.4
RDS04	73	78.1	17.8	15.1	2.7	2.7	0.0	0.0	2.7	1.4	1.4	6.8
RDS05	52	80.8	3.8	3.8	0.0	9.6	5.8	1.9	1.9	5.8	0.0	0.0
RDS06	85	92.9	0.0	0.0	0.0	1.2	0.0	0.0	1.2	5.9	0.0	0.0
RDS07	72	81.9	4.2	2.8	1.4	5.6	0.0	0.0	5.6	8.3	0.0	0.0
RDS08	51	96.1	2.0	2.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0
RDS09	64	87.5	3.1	3.1	0.0	6.3	4.7	0.0	1.6	3.1	1.6	0.0
RDS10	61	93.4	1.6	1.6	0.0	3.3	3.3	0.0	0.0	1.6	0.0	0.0
RDS11	70	80.0	5.7	5.7	0.0	5.7	4.3	0.0	1.4	8.6	1.4	1.4
RDS12	67	83.6	3.0	3.0	0.0	6.0	1.5	0.0	4.5	7.5	3.0	1.5
RDS13	74	90.5	2.7	2.7	0.0	4.1	1.4	0.0	2.7	2.7	0.0	0.0
RDS14	68	95.6	0.0	0.0	0.0	1.5	0.0	0.0	1.5	2.9	0.0	0.0
RDS15	54	94.4	0.0	0.0	0.0	5.6	1.9	0.0	3.7	0.0	0.0	0.0
RDT02	78	79.5	9.0	9.0	0.0	5.1	2.6	0.0	2.6	6.4	25.6	43.6
RDT03	36	75.0	19.4	19.4	0.0	2.8	0.0	0.0	2.8	2.8	2.8	11.1
RDT04	68	88.2	4.4	4.4	0.0	2.9	2.9	0.0	0.0	4.4	2.9	1.5
RDT05	61	96.7	1.6	1.6	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6
RDT06	34	88.2	0.0	0.0	0.0	2.9	0.0	0.0	2.9	8.8	0.0	0.0
RDT07	44	81.8	4.5	4.5	0.0	2.3	2.3	0.0	0.0	11.4	0.0	0.0
RDT08	57	84.2	1.8	1.8	0.0	7.0	0.0	0.0	7.0	7.0	0.0	0.0
RDT09	57	80.7	7.0	7.0	0.0	8.8	3.5	0.0	5.3	3.5	0.0	0.0
RDT9.5	86	93.0	1.2	1.2	0.0	0.0	0.0	0.0	0.0	5.8	0.0	0.0
RDT10	75	85.3	2.7	2.7	0.0	5.3	1.3	0.0	4.0	6.7	0.0	0.0
RDT11	65	98.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0
RDT12	58	84.5	5.2	5.2	0.0	6.9	3.4	0.0	3.4	3.4	0.0	0.0
RDT13	70	85.7	4.3	4.3	0.0	8.6	2.9	0.0	5.7	1.4	1.4	0.0
RDT14	46	93.5	2.2	2.2	0.0	4.3	4.3	0.0	0.0	0.0	4.3	0.0
RDT15	40	85.0	7.5	7.5	0.0	5.0	0.0	0.0	5.0	2.5	0.0	0.0
RDV02	90	87.8	3.3	3.3	0.0	1.1	1.1	0.0	0.0	7.8	18.9	60.0
RDV03FD	43	93.0	2.3	2.3	0.0	2.3	0.0	0.0	2.3	2.3	2.3	7.0
RDV04	38	65.8	28.9	26.3	2.6	5.3	0.0	0.0	5.3	0.0	0.0	0.0
RDV05	41	68.3	19.5	19.5	0.0	9.8	2.4	0.0	7.3	2.4	0.0	2.4
RDV06	48	64.6	20.8	20.8	0.0	6.3	2.1	0.0	4.2	8.3	0.0	0.0
RDV07	58	72.4	19.0	19.0	0.0	1.7	0.0	0.0	1.7	6.9	1.7	0.0
RDV07-2	54	83.3	0.0	0.0	0.0	1.9	0.0	0.0	1.9	14.8	0.0	0.0
RDV08	41	97.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
RDV09	74	95.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0

Sample Site	# of clasts (n)	Clastic Seds %	Intrusive Lithologies			Extrusive Lithologies				Quartz	Conglom-erate	Red Seds
			%	Granitic %	Gabbroic %	%	Mafic %	M-F %	Felsic %	%	%	%
RDV10	43	90.7	2.3	0.0	2.3	4.7	4.7	0.0	0.0	2.3	0.0	0.0
RDV11	31	84.4	0.0	0.0	0.0	15.6	9.4	0.0	6.3	0.0	3.1	0.0
RDV12	36	75.0	11.1	8.3	2.8	11.1	0.0	0.0	11.1	2.8	0.0	0.0
RDV13	53	86.8	9.4	1.9	7.5	3.8	3.8	0.0	0.0	0.0	0.0	0.0
RDV14	53	81.1	1.9	1.9	0.0	9.4	3.8	0.0	5.7	7.5	3.8	3.8
RDV15	44	79.5	20.5	15.9	4.5	0.0	0.0	0.0	0.0	0.0	4.5	0.0
RDW02	43	65.1	16.3	7.0	9.3	18.6	11.6	0.0	7.0	0.0	2.3	7.0
RDW03	50	70.0	12.0	10.0	2.0	0.0	0.0	0.0	0.0	18.0	0.0	2.0
RDW04	63	87.3	1.6	0.0	1.6	1.6	0.0	0.0	1.6	9.5	0.0	12.7
RDW05	37	81.1	10.8	10.8	0.0	0.0	0.0	0.0	0.0	8.1	0.0	5.4
RDW06	32	84.4	6.3	6.3	0.0	6.3	6.3	0.0	0.0	3.1	0.0	6.3
RDW07	55	89.1	1.8	1.8	0.0	7.3	3.6	0.0	3.6	1.8	0.0	0.0
RDW08	49	73.5	4.1	4.1	0.0	8.2	6.1	0.0	2.0	14.3	0.0	2.0
RDW09	59	89.8	3.4	3.4	0.0	5.1	5.1	0.0	0.0	1.7	0.0	0.0
RDW10	38	74.4	12.8	12.8	0.0	12.8	5.1	0.0	7.7	0.0	0.0	0.0
RDW11	37	83.8	5.4	5.4	0.0	10.8	8.1	0.0	2.7	0.0	0.0	0.0
RDW12	47	66.0	19.1	14.9	4.3	12.8	12.8	0.0	0.0	2.1	0.0	0.0
RDW13	53	69.8	22.6	1.9	20.8	7.5	0.0	0.0	7.5	0.0	0.0	0.0
RDW14	67	59.7	34.3	13.4	20.9	6.0	4.5	0.0	1.5	0.0	3.0	0.0
RDW15	36	58.3	22.2	11.1	11.1	19.4	13.9	0.0	5.6	0.0	2.8	0.0
RDX02	76	76.3	21.1	11.8	9.2	1.3	0.0	0.0	1.3	1.3	13.2	18.4
RDX03	58	77.6	15.5	10.3	5.2	6.9	1.7	0.0	5.2	0.0	3.4	10.3
RDX04	45	82.2	15.6	13.3	2.2	2.2	0.0	0.0	2.2	0.0	4.4	13.3
RDX05	51	74.5	17.6	15.7	2.0	5.9	2.0	0.0	3.9	2.0	2.0	9.8
RDX06	79	92.4	1.3	1.3	0.0	1.3	0.0	0.0	1.3	5.1	0.0	2.5
RDX07	49	87.8	6.1	6.1	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0
RDX08	47	76.6	12.8	12.8	0.0	4.3	0.0	0.0	4.3	6.4	0.0	2.1
RDX09	70	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RDX10	42	71.4	16.7	14.3	2.4	7.1	0.0	0.0	7.1	4.8	0.0	0.0
RDX10-1	30	80.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RDX11	66	78.8	16.7	13.6	3.0	3.0	0.0	0.0	3.0	1.5	0.0	0.0
RDX12	36	83.3	16.7	5.6	11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RDX13	39	38.5	12.8	0.0	12.8	48.7	0.0	0.0	48.7	0.0	0.0	0.0
RDX14	59	62.7	22.0	6.8	15.3	15.3	0.0	0.0	15.3	0.0	0.0	1.7
RDX15	78	19.2	78.2	38.5	39.7	0.0	0.0	0.0	0.0	2.6	0.0	0.0

APPENDIX IV

Geochemical Analyses Data

Part A: Geochemical Results from ICP-MS Analysis

ICP-MS analysis was conducted on the clay plus silt (<0.063 mm) fraction of the 272 collected till samples by ACME Analytical Laboratories®, Vancouver, British Columbia. Analysis for 37 elements (listed below) was performed using ACME's Ultratrace ICP-MS technique where inductively coupled plasma mass spectrometry analysis followed aqua regia digestion of 15 g of an individual sample. Table IV-1 lists all elements analyzed as well as the corresponding detection limit.

Element	Detection Limit	Element	Detection Limit	Element	Detection Limit
Au	0.2 ppb	Mo	0.01 ppm	Sb	0.02 ppm
Ag	2 ppb	Na	0.001 %	Sc	0.1 ppm
Al	0.01 %	Ni	0.1 ppm	Se	0.1 ppm
As	0.1 ppm	P	0.001 %	Sr	0.5 ppm
B	1 ppm	Pb	0.01 ppm	Te	0.02 ppm
Ba	0.5 ppm	S	0.02 %	Th	0.1 ppm
Bi	0.02 ppm	Hg	5 ppb	Ti	0.001 %
Ca	0.01 %	Ga	0.1 ppm	Tl	0.02 ppm
Cd	0.01 ppm	K	0.01 %	U	0.1 ppm
Co	0.1 ppm	La	0.5 ppm	V	2 ppm
Cr	0.5 ppm	Mg	0.01 %	W	0.1 ppm
Cu	0.01 ppm	Mn	1 ppm	Zn	0.1 ppm
Fe	0.01 %				

Table IV-1 – Elements analyzed and corresponding detection limit as defined by ACME Analytical Laboratories®. Method of analysis is ICP-MS.

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Ag – Co)

Sample ID	Till	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co
	Type	ppb	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm
RDA02	bT	6	1.47	5.8	0.3	< 1	42.9	0.15	0.05	0.03	9.6
RDA03-1	aT	101	1.95	6.6	0.6	1	47.4	0.18	0.04	0.03	8.1
RDA03-2	aT	42	1.73	9.4	1.4	1	52.4	0.18	0.05	0.03	10.8
RDA04	bT	21	1.54	8.8	0.6	1	65	0.19	0.14	0.03	11.4
RDB02	bT	14	1.8	6.9	2.6	1	60.7	0.16	0.07	0.06	12
RDB03	bT	12	1.39	10.1	1.2	1	34.2	0.16	0.19	0.04	10.6
RDB04	bT	20	1.58	9.8	1.2	< 1	34.4	0.17	0.14	0.03	9.4
RDB05	bT	6	1.32	9.2	0.7	1	41.3	0.16	0.08	0.04	9.1
RDB06	bT	46	1.47	6.4	2.4	1	73.4	0.15	0.15	0.03	11.9
RDB13	bT	89	1.81	8	0.5	< 1	53.5	0.17	0.03	0.06	8.1
RDB14	bT	49	1.94	11.3	1.3	1	39.3	0.16	0.04	0.06	11.1
RDB15	bT	10	1.44	7.8	1.2	1	49	0.17	0.07	0.03	11.6
RDC02	aT	58	2.4	12.9	0.8	1	41.9	0.19	0.05	0.06	12.2
RDC03	bT	7	1.51	8.7	0.6	1	75.7	0.18	0.12	0.04	13.8
RDC04	bT	25	1.87	5.6	1.2	1	38.8	0.12	0.05	0.04	8.3
RDC05	bT	20	1.97	9.6	1.4	2	38.1	0.2	0.04	0.04	12.8
RDC06	bT	58	2.18	9.8	2	1	55.8	0.19	0.04	0.05	9.3
RDC07	aT	67	1.85	13.6	1.9	1	36.6	0.17	0.04	0.05	8.4
RDC12	bT	45	2.01	7.1	1.3	1	55.8	0.15	0.07	0.05	10
RDC13	bT	42	1.44	8.5	< .2	1	34.8	0.23	0.14	0.03	8.2
RDC14	bT	33	1.74	7	0.8	1	50.7	0.13	0.04	0.05	9.2
RDC15	bT	87	1.46	8.8	1	1	41.9	0.12	0.03	0.09	7.9
RDCD11	bT	9	1.81	11.1	0.6	1	60.6	0.19	0.04	0.05	12.7
RDD02	aT	21	1.91	7.8	1.1	1	36.6	0.17	0.04	0.05	6.8
RDD03	bT	6	1.49	5.6	0.5	1	51.2	0.14	0.09	0.02	9.3
RDD04	bT	5	1.41	3.7	< .2	1	38.8	0.11	0.03	0.02	8.1
RDD05	aT	29	1.98	12.3	1.2	1	50.9	0.21	0.04	0.09	12.9
RDD06	bT	10	2.1	8.2	< .2	1	62.6	0.33	0.05	0.03	13.7
RDD07	bT	6	1.79	10.1	1	1	70.4	0.22	0.09	0.04	12.8
RDD08	aT	16	2.17	12.2	0.5	1	44.5	0.22	0.04	0.07	10
RDD09	bT	6	1.44	12.1	1.1	1	47.6	0.19	0.19	0.05	11.7
RDD10	bT	6	1.45	12.4	0.5	1	46.7	0.19	0.23	0.03	10.9
RDD12	bT	27	1.69	13	0.7	1	33.5	0.18	0.05	0.07	11.1
RDD13-1	bT	29	1.77	7.5	1.5	< 1	49.5	0.14	0.12	0.03	7.9
RDD13-2	bT	34	2.05	12.3	2.1	2	72.9	0.22	0.05	0.07	14.8
RDD14	bT	25	1.36	12.6	1.5	1	39.6	0.15	0.12	0.05	9.7
RDD15	bT	17	1.95	10.2	0.9	1	66.1	0.19	0.26	0.01	13.4
RDE02	bT	14	2.11	6.9	0.8	1	34.2	0.17	0.08	0.07	5.9
RDE03	bT	19	1.72	7.5	2.9	1	38.1	0.17	0.05	0.03	7.6
RDE04	bT	33	1.83	6.6	1.2	1	38.4	0.16	0.12	0.03	8.7
RDE05	bT	6	1.96	13.5	1.4	1	52.4	0.21	0.14	0.03	17.4
RDE07	bT	14	2.34	4.6	< .2	< 1	58.6	0.17	0.06	0.01	11.8
RDE08	bT	24	1.68	5.9	1.2	< 1	46.9	0.18	0.18	0.03	10.5
RDE09	bT	26	1.83	11.5	0.7	< 1	59	0.22	0.03	0.03	10.6

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Ag – Co) Continued

Sample ID	Till	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co
	Type	ppb	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm
RDE10	bT	5	1.58	6.9	1	< 1	48.9	0.18	0.15	0.02	10.9
RDE11	bT	17	1.98	9.8	0.6	< 1	57.4	0.17	0.2	0.04	15.4
RDE12	aT	122	2.51	18.4	1	1	46.4	0.26	0.13	0.09	17.3
RDE13	bT	37	1.97	9.4	1.3	1	47.9	0.16	0.15	0.04	9.8
RDE14	bT	14	1.7	9.2	5.8	< 1	52.7	0.19	0.04	0.04	10.1
RDE15	bT	12	2.13	11.7	0.3	1	64.6	0.18	0.03	0.06	10.6
RDEF06	bT	7	1.84	8	2.9	1	57.4	0.17	0.13	0.05	11.4
RDF02	aT	13	1.29	9	3.9	1	24.3	0.22	0.16	0.07	13.4
RDF03	bT	11	1.13	8.2	1.5	1	28.7	0.16	0.14	0.05	9.9
RDF04	bT	39	1.28	9.6	1.4	< 1	20.2	0.17	0.14	0.06	7.9
RDF05	bT	7	1.33	8.8	1.9	1	38.3	0.17	0.16	0.06	10.4
RDF07	bT	4	1.3	11.6	1.2	1	42.1	0.17	0.18	0.04	11.6
RDF08	bT	77	2.29	7	0.7	1	63.3	0.2	0.05	0.03	10.1
RDF09	bT	7	1.76	14.5	1.2	1	39.4	0.27	0.2	0.04	14.7
RDF10	bT	40	1.77	10.1	2.8	1	32.9	0.18	0.11	0.06	8.9
RDF11	aT	24	2.55	18.8	0.8	1	78.5	0.26	0.14	0.03	14.3
RDF12	bT	209	1.95	12.1	0.2	1	44.1	0.23	0.13	0.12	5
RDF13	aT	26	2.45	23.7	1.3	1	52.1	0.16	0.04	0.05	13
RDF14	bT	80	2.54	14	2.3	2	66.5	0.2	0.04	0.07	10.3
RDF15	bT	99	2.03	10.5	1.4	1	55.5	0.17	0.03	0.04	8.5
RDG02	bT	20	1.52	7.3	2.8	1	51.9	0.2	0.23	0.04	10
RDG03	bT	7	1.31	6.3	0.8	1	42.9	0.17	0.21	0.02	9.5
RDG04	bT	14	1.35	11.9	0.8	1	43.8	0.22	0.4	0.03	13.5
RDG05	bT?	41	1.65	21.9	1.5	1	63.7	0.29	0.24	0.05	19.3
RDG06	aT	44	1.99	12.9	1.6	2	35.9	0.19	0.12	0.07	10.5
RDG07	bT?	4	1.52	14	1	2	39.2	0.18	0.16	0.05	10.7
RDG08	bT	24	2.12	14.7	1.2	2	41.9	0.2	0.13	0.08	9.8
RDG09	bT	7	1.7	9.5	1	1	56.1	0.2	0.19	0.03	10.6
RDG10	aT	63	2.01	6.9	1.3	2	44.6	0.19	0.04	0.03	10.3
RDG11	aT?	154	2.09	23	2	1	36.9	0.24	0.07	0.1	12.7
RDG12	bT	12	2.15	15.7	0.9	2	101.7	0.28	0.34	0.04	16.2
RDG12FD	bT	10	2.28	12.6	0.8	1	69.9	0.26	0.21	0.05	14.2
RDG13	bT	10	1.61	10.7	1.1	1	54.2	0.23	0.24	0.04	14.3
RDG14a	aT	100	3.69	34.2	1	1	40	0.35	0.04	0.09	8.9
RDG14b	bT	22	1.91	15.2	1.3	1	58.9	0.18	0.24	0.04	14.1
RDG15	aT	44	2.28	23.3	0.7	1	64.1	0.29	0.04	0.1	15
RDH02	bT	11	1.01	8.2	3.4	1	48.1	0.15	0.19	0.03	8
RDH03	aT	8	1.2	7.6	2.3	1	19.9	0.16	0.18	0.02	7
RDH04	aT	98	5.77	38.3	0.6	2	48.3	0.44	0.14	0.11	13.5
RDH05	bT?	41	2.34	11.4	0.8	2	68.4	0.4	0.23	0.08	10
RDH06	bT	18	1.5	27.8	3.4	1	43.2	0.32	0.31	0.07	17.6
RDH07	bT	38	2.09	11.6	0.5	1	49.2	0.21	0.13	0.06	8
RDH08	bT	87	1.78	6.4	1.7	1	40.9	0.14	0.03	0.05	5.9
RDH09	bT	34	1.13	9.3	0.9	1	49	0.15	0.26	0.04	10.3

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Ag – Co) Continued

Sample ID	**Till**	**Ag**	**Al**	**As**	**Au**	**B**	**Ba**	**Bi**	**Ca**	**Cd**	**Co**
	Type	ppb	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm
RDH10	?	35	1.36	13.6	0.8	1	48.4	0.25	0.22	0.06	12.9
RDH11	bT	30	1.74	12.2	0.8	1	40.5	0.21	0.14	0.04	10.1
RDH12	bT	73	1.6	6.9	1.4	1	41.1	0.16	0.13	0.02	8.5
RDH13	bT	14	1.75	14	3.5	1	59.1	0.23	0.16	0.05	12.8
RDH14.5	bT	47	1.92	16.8	1.4	1	46.3	0.2	0.05	0.08	13.1
RDK02	bT	18	1.68	11	2.4	1	27.8	0.19	0.07	0.04	12.7
RDK03	bT	11	1.46	8.2	5.8	1	27.3	0.17	0.03	0.05	6.3
RDK04	bT	7	1.62	21.4	11.7	1	34.7	0.21	0.06	0.04	14.4
RDK05	bT	14	1.42	6.4	1.2	1	27.5	0.14	0.05	0.02	5.6
RDK06	aT	35	1.08	16.9	0.4	1	17.4	0.17	0.26	0.06	11.4
RDK07	aT	34	1.3	7	0.9	1	22.4	0.18	0.21	0.04	7.8
RDK08	bT	57	2.54	11.5	2.8	1	52.5	0.21	0.04	0.1	15.4
RDK09	bT	45	1.38	9.3	1	1	30.2	0.17	0.1	0.07	7.6
RDK10	bT	73	1.62	4.8	8.2	1	36.1	0.15	0.06	0.02	8.6
RDK11	bT	7	1.69	10.3	0.6	1	60.3	0.18	0.2	0.03	11.5
RDK12	aT?	11	1.88	80.4	1.1	1	35.8	0.28	0.03	0.07	19.3
RDK13	bT	47	2.95	26.1	1	< 1	38.1	0.41	0.02	0.08	8.5
RDK14	bT?	69	2.27	7.4	1.4	< 1	44.6	0.28	0.04	0.04	7.6
RDK15	bT	62	1.76	10.7	1	1	34.1	0.27	0.06	0.05	9.6
RDL02	aT	423	2.98	20.1	0.9	1	44	0.28	0.06	0.1	11.5
RDL03	bT	22	1.79	13.7	1.4	1	39.8	0.2	0.09	0.03	11.9
RDL04	bT	26	1.58	15.4	1.4	1	37.5	0.21	0.06	0.03	11.3
RDL05	bT	85	1.86	13	0.9	1	58.5	0.19	0.1	0.07	9.8
RDL06	aT	106	2.03	13.9	0.7	1	24.4	0.18	0.06	0.09	9.2
RDL07	bT	12	1.27	5.4	1.6	1	31.5	0.14	0.15	0.02	6.2
RDL08	bT	18	2.61	9.7	1.8	1	53	0.23	0.07	0.05	10.5
RDL09	bT	10	1.8	10.3	0.7	1	54	0.22	0.07	0.07	13.4
RDL10	aT	126	2.04	11.6	1.1	1	44.2	0.16	0.04	0.09	12.4
RDL11a	aT	31	1.78	88.7	4.2	1	20.1	0.26	0.11	0.1	14.1
RDL11b	aT	33	1.93	117.6	1.4	1	47.3	0.38	0.21	0.05	13.8
RDL12	aT	100	1.84	26.3	1.2	1	29.2	0.22	0.05	0.14	10.1
RDL13	aT	150	1.74	14.8	0.9	1	104.7	1.61	0.02	0.06	8.2
RDL14	bT	11	1.65	29.1	0.8	< 1	53.3	0.3	0.09	0.05	17.8
RDL15	bT	45	2.25	18.4	< .2	2	89.4	0.45	0.33	0.09	22.8
RDM02	aT	47	1.93	17.6	1.3	1	27.1	0.24	0.15	0.08	15.7
RDM03	bT	50	1.53	13.7	1.2	1	63.9	0.2	0.17	0.08	13.3
RDM03FD	bT	43	1.3	14	< .2	1	48.5	0.18	0.22	0.07	12.1
RDM04	bT	27	1.45	20.7	1.3	< 1	25.4	0.22	0.21	0.07	14
RDM05	bT	111	2.04	11.3	< .2	1	34.2	0.17	0.13	0.11	8.4
RDM06	bT	43	1.89	17.1	1.7	1	23.6	0.21	0.14	0.11	8.9
RDM07	bT	11	1.09	9.7	0.6	1	34.8	0.19	0.23	0.03	9.3
RDM08	bT	54	1.88	10.9	0.9	1	40	0.17	0.05	0.06	7.8
RDM09	bT	17	1.84	9.7	0.9	1	43.6	0.17	0.03	0.06	9.8
RDM10	bT	8	1.53	18.5	0.7	1	66.1	0.2	0.22	0.02	15

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Ag – Co) Continued

Sample ID	**Till**	**Ag**	**Al**	**As**	**Au**	**B**	**Ba**	**Bi**	**Ca**	**Cd**	**Co**
	Type	ppb	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm
RDM11	aT	59	2.47	29.3	2.2	1	42.1	0.28	0.03	0.08	11.6
RDM12	bT	314	2.43	129.6	1.4	1	48.3	0.82	0.05	0.19	15.4
RDM13	bT	10	2.38	15.1	1.1	2	92.1	0.26	0.18	0.06	16
RDM14	bT?	21	1.77	17.2	1.4	1	71.4	0.58	0.18	0.08	14.6
RDM15-1	aT	23	2.12	45.7	1.8	1	61.1	0.5	0.2	0.12	26.1
RDM15-2	bT	12	2.03	32.5	5.7	2	88.8	0.38	0.31	0.07	20.1
RDN02	bT	23	0.92	9.8	3.2	1	34.8	0.19	0.24	0.03	7.9
RDN03	aT	13	1.06	10.5	4.2	1	20.4	0.16	0.16	0.04	9.1
RDN04	bT	38	2.16	19.2	37.4	1	24.3	0.23	0.06	0.06	13.2
RDN05	bT	52	1.82	16.6	1	< 1	23.1	0.21	0.06	0.08	12.3
RDN06	bT	27	1.32	7.2	0.2	1	32.8	0.14	0.05	0.05	8.6
RDN07	aT	27	1.5	19.3	1.1	1	33.8	0.23	0.16	0.07	12.8
RDN08	aT	8	1	25	1.8	1	31.6	0.22	0.15	0.05	10.1
RDN09	bT	7	1.8	9.9	1	1	61.4	0.2	0.17	0.04	10.4
RDN10	bT	36	2.03	46.5	2.6	1	37.8	0.26	0.03	0.06	14.4
RDN11	bT?	181	2.68	83.7	1.4	1	29.8	0.28	0.16	0.11	15.4
RDN12	bT	23	2.12	87.9	6.3	1	80.6	0.4	0.15	0.02	21.7
RDN13	aT?	187	2.06	13.5	2.7	2	35.4	1.04	0.02	0.04	5.1
RDN14	bT	56	2.25	26.3	1.8	2	32.8	0.34	0.13	0.05	8.3
RDN15	bT	28	2.17	29.3	2.2	1	32.7	1.04	0.13	0.07	9.7
RDP02	bT	54	1.68	11.7	2.5	1	38.1	0.19	0.08	0.07	11.2
RDP03	bT	9	1.85	10.8	1.8	1	52.8	0.23	0.08	0.05	12.9
RDP04	bT	29	1.88	13.2	1.6	1	29.6	0.2	0.04	0.05	8.9
RDP05	aT	15	1.45	23.4	0.6	1	41.8	0.26	0.2	0.11	20.9
RDP06	bT	28	2.43	9.4	2.4	1	40.3	0.13	0.03	0.05	7.9
RDP07	bT	7	1.93	15.3	1.1	1	43.1	0.2	0.04	0.04	9.6
RDP08	bT	13	1.83	10.9	1.5	1	40.7	0.23	0.06	0.07	14.6
RDP09	aT	10	1.3	21.1	1	< 1	19.6	0.2	0.1	0.05	15.5
RDP10	bT	47	2.28	14.6	0.7	1	45.1	0.2	0.03	0.08	10.7
RDP11	bT	12	2	27.1	1.2	1	68.7	0.23	0.13	0.05	15.3
RDP12	bT	8	2.5	37.3	2	1	79.9	0.3	0.05	0.05	18.2
RDP13	bT	16	2.02	29.1	0.4	1	41.6	0.26	0.04	0.04	10.8
RDP14	aT	40	1.87	30	1.2	< 1	30.7	0.42	0.04	0.11	11.8
RDP15	bT	28	1.93	17.6	1.3	< 1	34.1	0.24	0.03	0.05	5.7
RDQ02	bT	40	1.87	7.5	1.6	1	48.4	0.22	0.08	0.07	10.1
RDQ03	bT	13	1.84	8.4	1.4	1	51.6	0.22	0.11	0.03	9.7
RDQ04	bT	19	2.35	15.7	0.6	1	51.5	0.25	0.09	0.06	14.8
RDQ05	bT	25	1.74	10.7	1	1	36.6	0.2	0.12	0.07	11
RDQ06	bT	14	2.09	24.4	1.3	1	43.8	0.33	0.08	0.02	12.2
RDQ07	aT	70	2.15	35.7	1.5	< 1	30.4	0.28	0.02	0.06	6.4
RDQ09	bT	22	1.56	143.5	1.3	1	20.4	0.49	0.08	0.04	13.7
RDQ10	bT	64	2.95	146.1	1.9	1	35.5	0.57	0.02	0.09	22
RDQ11	bT	18	1.69	17.4	1.3	1	35.4	0.24	0.11	0.06	18.4
RDQ12	bT	8	1.64	10.4	1.1	1	47.3	0.18	0.09	0.04	11.2

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Ag – Co) Continued

Sample ID	Till	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co
	Type	ppb	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm
RDQ13	bT?	29	2.83	32.8	1.7	1	31.9	0.27	0.04	0.14	15.6
RDQ14	bT	45	2	21.6	18.9	1	37.3	0.22	0.04	0.06	8.2
RDQ15	bT	94	2.38	19.7	1.1	2	55.9	0.24	0.06	0.09	9.3
RDR02	bT	21	1.71	7.1	2.5	1	36.7	0.19	0.08	0.06	6.9
RDR03	bT	33	1.99	7.1	1.3	1	36.4	0.2	0.11	0.06	10.4
RDR04	bT	4	1.85	12.6	1.8	1	51.4	0.24	0.11	0.05	12.4
RDR05	bT?	92	2.3	16.7	0.8	< 1	41.7	0.21	0.03	0.09	11.9
RDR06	bT?	19	2.02	110	2.3	1	29.4	0.34	0.03	0.04	10.4
RDR07	bT	6	2.49	93.8	2.8	2	63.8	0.37	0.26	0.03	16.9
RDR08	bT	21	1.78	25.7	1.5	1	36.7	0.25	0.03	0.09	11.6
RDR09	bT?	11	2.32	21.9	5.2	1	30.1	0.4	0.02	0.16	22.9
RDR10	bT	5	2.13	27.6	1.8	1	71.8	0.27	0.05	0.04	15.6
RDR11	bT	18	1.54	15.4	< .2	1	44	0.19	0.14	0.04	10.2
RDR12	bT	113	2.4	19.1	1.6	1	55.9	0.24	0.05	0.1	15.3
RDR12FD	bT	22	2.4	19.2	2.6	1	59.5	0.25	0.05	0.08	18.7
RDR13	bT	139	1.89	10.1	0.6	1	46.2	0.21	0.06	0.08	7.1
RDR14	aTv	410	3.18	44.2	2.2	1	47.9	0.39	0.02	0.08	9.9
RDR15	bT	35	2.64	12.8	1.8	2	58.5	0.22	0.03	0.06	15.6
RDS02	bT	26	2.08	5.2	1.1	1	31	0.23	0.02	0.03	2.8
RDS03	bT	3	1.29	9	3.5	1	46.4	0.2	0.12	0.03	7.5
RDS04	bT	5	1.74	11.9	1.1	1	44.8	0.21	0.09	0.06	9.4
RDS05	aT?	319	3.37	77.5	0.9	1	33.3	1.14	0.03	0.13	7.3
RDS06	bT	72	2.2	68.5	2.2	< 1	39	0.45	0.02	0.12	17.7
RDS07	bT	41	2.49	51.9	0.5	1	49.9	0.33	0.02	0.07	10.6
RDS07.5	bT	16	1.92	17.1	1.4	1	40.5	0.24	0.09	0.06	19.8
RDS08	bT	8	2.22	23.9	1.8	1	47.3	0.25	0.08	0.05	15.5
RDS09	bT	36	2.33	43.9	0.8	1	46	0.28	0.05	0.08	18.2
RDS10	bT	131	2.3	31.8	0.5	1	42.7	0.28	0.06	0.08	14.7
RDS11	bT	39	2.21	15.2	< .2	1	59.4	0.24	0.04	0.07	10.7
RDS12	bT	19	2.13	15.6	0.9	1	46.5	0.23	0.05	0.09	13.7
RDS12FD	bT	11	2.38	17.2	0.5	1	57.4	0.23	0.05	0.06	16.1
RDS13	bT	15	2.01	11.5	0.4	1	44.9	0.17	0.08	0.05	12.5
RDS14	bT?	32	1.82	9.7	0.5	< 1	43.8	0.16	0.04	0.27	9.5
RDS15	bT	8	2.36	16.5	1.4	2	85.9	0.3	0.18	0.05	16.4
RDT02	bT	48	1.62	14.7	< .2	1	72.8	0.39	0.2	0.05	10.8
RDT03	bT	163	2.19	51.2	1.5	2	43.9	0.31	0.05	0.1	10.5
RDT04	aT	381	2.44	392.6	2.6	1	39	0.69	0.04	0.18	13.6
RDT05	bT	157	2.4	52	2.1	1	51.2	0.66	0.02	0.13	13.9
RDT06	bT	24	2.23	19.6	1.7	1	49.6	0.26	0.09	0.02	11.8
RDT07	aT	5	1.68	39.4	1.9	1	29	0.45	0.12	0.05	27.7
RDT08	aT	15	2.55	63.2	2.9	< 1	32.9	0.46	0.04	0.11	28.5
RDT09	bT	15	2.1	41	3	< 1	32.3	0.29	0.03	0.05	12.2
RDT9.5	bT	21	2.19	61.1	3.1	1	31.8	0.3	0.06	0.08	19.7
RDT10	bT	117	2.16	51.2	2.5	1	46	0.29	0.08	0.14	9.5

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Ag – Co) Continued

Sample ID	Till Type	Ag ppb	Al %	As ppm	Au ppb	B ppm	Ba ppm	Bi ppm	Ca %	Cd ppm	Co ppm
RDT11	bT	93	3.43	90.9	6.7	1	32.2	0.48	0.02	0.09	5.7
RDT12	bT	23	2.54	27.1	2.3	1	44.4	0.3	0.08	0.19	20.5
RDT13	bT	44	1.84	14.1	8.8	1	44.1	0.19	0.05	0.09	10.3
RDT14	bT	34	2.05	8.7	1.9	1	52.6	0.27	0.04	0.04	10.1
RDT15	bT	15	2.33	15.8	1.5	2	56.9	0.26	0.04	0.09	16.9
RDV02a	bT	14	1.63	66.4	1.9	2	40.6	0.35	0.2	0.1	19.9
RDV02b	bT	8	1.48	19.2	1.7	1	47.2	0.23	0.2	0.04	8.2
RDV03	bT	16	2.67	15.8	1.9	2	93.4	0.34	0.12	0.05	16.3
RDV03FD	bT	9	2.53	19.1	1.2	2	103.5	0.32	0.14	0.05	15
RDV04	bT	64	2.04	21.2	1.2	2	62.6	0.42	0.13	0.05	13.7
RDV05	bT	12	1.72	14.8	2.3	2	50.4	0.22	0.1	0.02	10.9
RDV06	bT	10	2.38	50.4	1.3	2	57.4	0.68	0.03	0.1	14.7
RDV07a	aT?	9	1.96	22.3	1	1	37	0.3	0.05	0.1	11.4
RDV07b	bT	85	2.44	33.1	1.1	1	61.3	0.32	0.04	0.18	18.1
RDV08	bT	51	2.57	16.8	1.3	1	57.1	0.37	0.05	0.11	14
RDV09	bT	13	1.94	175.7	0.5	< 1	29.9	3.84	0.08	0.32	23.9
RDV10	aT	141	2.69	75.9	1.4	1	20.8	7.6	0.02	0.15	7.2
RDV11	aT?	127	2.29	19.7	0.6	1	40.6	0.29	0.04	0.12	9.1
RDV12	bT	160	1.98	33.5	95	1	33.4	0.23	0.15	0.09	8.4
RDV13	bT	11	1.76	31.6	< .2	1	49.4	3.7	0.09	0.08	12.6
RDV14	bT	30	2.84	18.9	1.1	1	53.6	0.26	0.03	0.07	9.5
RDV15	bT	6	1.88	13.5	1.3	1	27	0.2	0.06	0.03	8.3
RDW02	bT	14	2.12	7.3	1	1	54.9	0.23	0.06	0.02	11.7
RDW03	bT	192	1.41	165.1	0.4	1	32.9	0.3	0.23	0.09	14.6
RDW04	bT	60	1.4	192	< .2	< 1	29.4	0.31	0.18	0.08	15.1
RDW05	bT	39	2.1	27.9	1.3	1	23.9	0.37	0.04	0.06	9
RDW06	bT	15	2.37	20.6	0.6	1	70.4	0.38	0.06	0.06	21.2
RDW07	aT	92	2.48	55.8	1.3	1	29.5	0.59	0.03	0.13	11.6
RDW08	bT?	11	2.29	62.1	2.3	< 1	61.5	1.35	0.1	0.1	18.8
RDW09	bT	30	2.35	28.1	1	1	51.2	2.05	0.02	0.18	12.6
RDW10	bT	108	2.32	22.8	1.4	< 1	26.9	2.44	0.03	0.11	7.1
RDW11	bT	12	1.97	35.3	2.3	< 1	55.4	0.68	0.11	0.12	18.2
RDW12	bT	99	2.21	43.7	2.1	< 1	57.9	0.34	0.04	0.11	12.8
RDW13	bT	45	2.34	21.8	1.3	< 1	40.7	0.27	0.04	0.15	12.8
RDW14	bT	46	2.38	16	3.9	1	43.8	0.29	0.04	0.11	10.8
RDW15	bT	41	1.83	10.1	0.5	< 1	33.4	0.23	0.11	0.08	12.5
RDX02	bT	31	1.55	10.1	0.6	1	42.7	0.29	0.09	0.05	7.5
RDX03	bT	9	1.86	47	1	1	58.5	0.27	0.08	0.06	12.8
RDX04	bT?	72	2.56	152.5	1.1	1	53.8	0.28	0.07	0.1	14.3
RDX05	bT?	14	1.87	17	< .2	1	48	0.29	0.05	0.06	13.9
RDX06	bT	14	1.84	55.1	0.9	1	46.5	0.47	0.12	0.08	24.7
RDX07	bT	62	2.21	19.5	0.4	1	55.8	0.37	0.06	0.05	12.4
RDX08	bT	16	2.16	34.1	2.5	1	68.7	0.49	0.11	0.13	15.3
RDX09	aT	2369	2.44	71.6	3.8	1	30.2	1.29	0.06	0.72	15.5

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Ag – Co) Continued

Sample ID	Till	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co
	Type	ppb	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm
RDX10a	aT	21	1.46	80.4	8.9	< 1	15.8	1.16	0.11	0.24	26.1
RDX10b	aT	10	1.74	50.3	2.8	< 1	34.2	0.94	0.07	0.18	22.1
RDX11	bT	20	2.39	74	4.6	< 1	48	3.06	0.04	0.3	21
RDX12-1	aT?	43	3.42	178.9	9.6	1	23.7	1.3	0.03	0.07	8.7
RDX12-2	aT?	94	3.29	110.5	5.6	< 1	34.3	0.65	0.03	0.15	10.2
RDX13	bT	155	2.55	216.1	2.8	1	49.3	0.63	0.03	0.17	10.3
RDX14	bT	24	2.43	53.2	1.3	1	50.9	0.31	0.04	0.14	13.5
RDX15	bT	14	1.81	23.5	18.3	1	29.5	0.32	0.08	0.08	11.3

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Cr - Mo)

Sample ID	Till	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo
	Type	ppm	ppm	%	ppm	ppb	%	ppm	%	ppm	ppm
RDA02	bT	29	14.78	2.1	4.3	23	0.06	29.3	0.58	473	0.26
RDA03-1	aT	34.6	15.37	2.08	5.2	31	0.05	22.5	0.59	245	0.38
RDA03-2	aT	33.8	17.1	2.28	4.8	23	0.06	24	0.63	473	0.4
RDA04	bT	32.4	16.96	2.48	4.9	18	0.09	32.1	0.69	752	0.39
RDB02	bT	38.5	18.79	2.52	5.1	39	0.09	31.3	0.72	515	0.38
RDB03	bT	33.2	14.95	2.15	4.3	19	0.06	23	0.66	384	0.52
RDB04	bT	30.7	11.86	1.94	3.8	49	0.06	21.5	0.5	401	0.34
RDB05	bT	24	13.96	1.93	3.7	29	0.06	22.9	0.46	426	0.3
RDB06	bT	33.1	12.71	2.16	4.3	22	0.06	25.9	0.61	299	0.31
RDB13	bT	32.7	19.49	2.12	4.7	46	0.05	28.5	0.54	200	0.39
RDB14	bT	38.4	20.04	2.58	4.3	47	0.05	24.9	0.65	298	0.38
RDB15	bT	28.2	16.38	2.45	4.3	27	0.1	32.7	0.65	615	0.37
RDC02	aT	37.7	21.21	2.58	4.7	84	0.05	24.3	0.63	382	0.55
RDC03	bT	29.9	24.52	2.63	4.9	30	0.14	28.5	0.69	805	0.32
RDC04	bT	32.7	13.1	2.22	4.9	59	0.04	24.1	0.54	229	0.37
RDC05	bT	31.7	22.33	2.77	4.2	44	0.05	25.2	0.57	287	0.52
RDC06	bT	36.3	16.55	2.67	5.7	87	0.08	23.8	0.56	274	0.5
RDC07	aT	30.1	17.97	2.26	4.4	52	0.04	20.9	0.5	358	0.4
RDC12	bT	38.6	9.92	2.59	5.6	71	0.08	28.7	0.7	391	0.51
RDC13	bT	30.5	13.5	2.34	3.9	33	0.05	24.2	0.6	225	0.36
RDC14	bT	32.8	14.57	2.26	4.7	47	0.04	25.6	0.58	208	0.33
RDC15	bT	25.6	14.36	2.17	3.7	45	0.04	24.1	0.51	310	0.33
RDCD11	bT	35.5	20.45	2.84	5.3	19	0.12	31.4	0.76	612	0.42
RDD02	aT	29.4	15.77	2.01	4.5	121	0.06	23.7	0.51	253	0.52
RDD03	bT	30.6	13.25	2.31	4.6	26	0.09	31.2	0.68	499	0.35
RDD04	bT	25	9.97	1.84	3.9	25	0.05	23.4	0.53	374	0.24
RDD05	aT	37.4	22.89	2.67	4.9	63	0.06	26.7	0.69	539	0.41
RDD06	bT	37.1	20.74	2.89	6.8	34	0.18	29.5	0.76	692	0.41
RDD07	bT	34	21.01	2.84	5.6	22	0.15	27.9	0.76	649	0.49
RDD08	aT	35.5	17	2.36	5.2	80	0.05	20.7	0.52	320	0.46

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Cr - Mo) Continued

Sample ID	Till Type	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppb	K %	La ppm	Mg %	Mn ppm	Mo ppm
RDD09	bT	28	21.58	2.52	4.5	15	0.09	28	0.62	623	0.42
RDD10	bT	29.2	23.03	2.62	4.6	17	0.07	27.8	0.64	740	0.4
RDD12	bT	36	22.71	2.58	4.3	54	0.05	24.1	0.67	298	0.41
RDD13-1	bT	33.8	15.47	2.25	4.6	53	0.07	21.4	0.63	252	0.41
RDD13-2	bT	39.8	23.05	3.19	6.3	53	0.12	30.2	0.77	739	0.55
RDD14	bT	29	19.13	2.34	3.8	29	0.06	25.2	0.53	413	0.37
RDD15	bT	44.5	19.83	3.2	6.5	36	0.12	29.8	0.86	397	0.29
RDE02	bT	37.9	8.87	2.78	5.6	73	0.04	22.8	0.46	229	0.57
RDE03	bT	31.4	12.95	2.33	4.5	46	0.07	22.6	0.49	272	0.41
RDE04	bT	44.3	14.1	2.63	6.1	72	0.07	24.2	0.72	382	0.72
RDE05	bT	41.9	25.58	3.3	5.7	28	0.12	30.5	0.88	807	0.52
RDE07	bT	41.3	10.76	2.69	6.2	25	0.07	27.7	0.79	216	0.52
RDE08	bT	38.5	11.42	2.36	5.4	63	0.1	25.3	0.67	668	0.75
RDE09	bT	37.7	20.56	2.9	5.7	47	0.06	35.6	0.7	524	0.48
RDE10	bT	31.8	12.87	2.47	5	29	0.06	25.4	0.59	594	0.47
RDE11	bT	40.9	21.66	3.08	6	28	0.11	29.8	0.9	831	0.51
RDE12	aT	44.1	21.95	2.8	5.8	114	0.08	22.5	0.73	370	0.65
RDE13	bT	40.3	12.36	2.65	5.8	79	0.09	23.3	0.71	384	0.52
RDE14	bT	34.7	16.44	2.63	4.8	54	0.1	27.4	0.65	563	0.56
RDE15	bT	37	21.77	2.88	5.7	41	0.1	30.7	0.72	416	0.41
RDEF06	bT	35.4	17.78	2.71	5.2	26	0.08	33.3	0.7	420	0.5
RDF02	aT	25.6	19.17	2.06	3.2	53	0.05	22.6	0.47	659	0.46
RDF03	bT	21.7	18.57	2.14	3.2	50	0.05	24.7	0.47	537	0.31
RDF04	bT	26.3	18.18	2.09	3.2	63	0.04	23.4	0.41	401	0.39
RDF05	bT	27.6	19.13	2.38	4	43	0.07	31.5	0.6	684	0.36
RDF07	bT	25.1	19.25	2.33	3.7	27	0.07	27.4	0.55	629	0.42
RDF08	bT	37	13.65	2.74	6.6	100	0.11	23.6	0.58	431	0.56
RDF09	bT	35	30.28	3.11	5	23	0.07	30.4	0.72	563	0.64
RDF10	bT	33.2	16.58	2.41	4.5	59	0.05	24.1	0.59	251	0.43
RDF11	aT	53.7	27.29	3.1	6.4	53	0.14	25.7	0.79	542	0.64
RDF12	bT	34.3	8.2	3.38	7.9	70	0.04	18.6	0.38	177	0.62
RDF13	aT	40.2	17.74	2.83	5.4	50	0.04	21.4	0.58	194	0.5
RDF14	bT	41.7	20.69	3.18	6.2	72	0.11	28	0.71	333	0.55
RDF15	bT	33.3	19.54	2.47	5.3	63	0.07	24.8	0.57	244	0.41
RDG02	bT	26	18.14	2.26	4.3	23	0.11	25.4	0.56	593	0.43
RDG03	bT	25.2	14.45	2.24	4.2	20	0.08	31.3	0.6	552	0.3
RDG04	bT	31.5	20.22	2.84	4.5	23	0.1	32.9	0.71	646	0.58
RDG05	bT?	38.9	25.43	3.84	5.3	18	0.06	32.3	0.85	315	0.8
RDG06	aT	37.5	21.73	2.63	4.3	66	0.05	24.5	0.59	361	0.48
RDG07	bT?	30.7	23.02	2.43	4	46	0.06	28.6	0.57	421	0.36
RDG08	bT	39.4	24.5	2.57	4.5	93	0.04	25.4	0.64	281	0.43
RDG09	bT	33.3	20.01	2.68	5.2	14	0.08	33.9	0.75	484	0.29
RDG10	aT	40.2	12.58	2.5	5.8	67	0.08	26.6	0.68	273	0.46
RDG11	aT?	40.3	21.41	2.99	5	58	0.04	25.7	0.72	304	0.39

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Cr - Mo) Continued

Sample ID	Till	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo
	Type	ppm	ppm	%	ppm	ppb	%	ppm	%	ppm	ppm
RDG12	bT	43	29.42	3.51	6.7	19	0.24	33.8	0.86	859	0.71
RDG12FD	bT	41	22.58	3.26	6.5	26	0.18	36	0.89	627	0.43
RDG13	bT	31.6	20.04	2.7	5.3	18	0.13	38.6	0.73	742	0.34
RDG14a	aT	43.3	19.44	4.13	8.4	206	0.05	24.7	0.48	277	1.54
RDG14b	bT	41.4	22.82	2.89	6	26	0.09	34.5	0.9	653	0.4
RDG15	aT	39.1	31.69	3.01	5.9	59	0.07	30.2	0.68	343	0.62
RDH02	bT	21.7	13.74	1.8	2.9	24	0.05	27	0.4	399	0.37
RDH03	aT	22.1	16.12	1.68	2.8	23	0.04	22	0.38	283	0.34
RDH04	aT	74.6	23.53	4.94	8.9	298	0.06	18	0.5	517	1.46
RDH05	bT?	38.2	16.49	2.69	6	70	0.1	25.4	0.64	776	0.75
RDH06	bT	36.4	43.38	3.15	4.7	25	0.07	32.2	0.82	628	0.41
RDH07	bT	33.3	13.5	3.13	6.8	55	0.04	23.2	0.41	188	0.53
RDH08	bT	31.1	8.75	2.12	5.4	82	0.06	22.8	0.38	205	0.36
RDH09	bT	28.3	20.09	2.14	3.5	27	0.05	27.7	0.59	375	0.27
RDH10	?	30.9	21.71	2.49	4.3	27	0.05	27.4	0.73	556	0.29
RDH11	bT	32.2	21.36	2.12	4.5	63	0.05	23.1	0.54	271	0.36
RDH12	bT	31.1	12.85	1.99	4.5	22	0.05	24.3	0.61	282	0.28
RDH13	bT	32.9	23.66	2.82	5.3	32	0.12	32.7	0.72	576	0.42
RDH14.5	bT	34.1	17.29	2.42	5	43	0.08	28.5	0.57	425	0.4
RDK02	bT	27.4	21.78	2.08	3.6	41	0.06	24.4	0.48	376	0.38
RDK03	bT	25.2	15.36	1.55	3.1	87	0.03	20.7	0.32	189	0.35
RDK04	bT	30.8	32.39	2.65	4.3	15	0.05	30.7	0.69	527	0.38
RDK05	bT	23.3	12.23	1.5	3.1	50	0.04	21.3	0.35	193	0.31
RDK06	aT	23.3	17.44	1.84	2.5	31	0.04	26.1	0.35	592	0.25
RDK07	aT	30.3	12.1	2.2	3.9	18	0.04	26.1	0.59	227	0.47
RDK08	bT	42	20.07	2.73	5.9	92	0.08	23.9	0.66	339	0.48
RDK09	bT	26.4	12.6	2.18	4.7	33	0.04	26.1	0.49	313	0.43
RDK10	bT	30.6	8.67	1.9	4.3	27	0.05	22.8	0.53	243	0.29
RDK11	bT	36.3	20.06	2.68	5.1	24	0.13	28.9	0.68	603	0.62
RDK12	aT?	29.1	33.06	2.85	4.9	43	0.06	41.9	0.61	501	0.45
RDK13	bT	38.5	24.07	3.94	6.5	93	0.04	21.3	0.39	196	2.56
RDK14	bT?	33.5	9.98	2.09	7.3	66	0.08	21.3	0.52	261	0.61
RDK15	bT	33.8	14.22	2.38	5.4	52	0.09	24.8	0.62	322	0.51
RDL02	aT	44.2	21.61	3.23	6.1	165	0.03	20.1	0.46	244	0.9
RDL03	bT	33.1	24.85	2.15	4.1	31	0.05	27.3	0.55	287	0.36
RDL04	bT	30.8	27.86	2.24	3.9	49	0.04	27.4	0.57	369	0.29
RDL05	bT	43.3	12.84	2.56	5.1	59	0.07	26.9	0.6	734	1.15
RDL06	aT	32.5	15.29	2.09	4	85	0.03	19.4	0.33	323	0.61
RDL07	bT	26.7	5.91	1.79	4.5	23	0.04	25.8	0.53	195	0.39
RDL08	bT	39.2	14.79	2.94	6.6	84	0.1	23.4	0.64	375	0.59
RDL09	bT	33	17.26	2.51	5	28	0.12	28.5	0.68	704	0.32
RDL10	aT	37	20.42	2.32	4.6	101	0.05	22	0.56	308	0.49
RDL11a	aT	32.4	20.08	2.25	3.6	94	0.05	24.7	0.48	514	0.45
RDL11b	aT	43.2	27.43	2.95	5.4	55	0.08	30.2	0.65	598	0.61

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Cr - Mo) Continued

Sample ID	Till	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo
	Type	ppm	ppm	%	ppm	ppb	%	ppm	%	ppm	ppm
RDL12	aT	28.6	16.35	2.25	4.2	69	0.05	28.3	0.47	374	0.43
RDL13	aT	30.2	46.05	5.59	5.1	21	0.07	46.2	0.46	266	4.09
RDL14	bT	29.7	33.06	2.86	4.9	20	0.13	29.6	0.63	654	0.87
RDL15	bT	43.7	33.06	3.74	7.8	35	0.37	33.4	1	1254	0.48
RDM02	aT	36.7	27.82	2.45	3.8	56	0.03	21.8	0.61	279	0.36
RDM03	bT	37.9	11.86	2.58	5.8	36	0.05	25.7	0.59	249	0.7
RDM03FD	bT	32.2	12.26	2.34	4.3	34	0.05	23.8	0.55	613	0.67
RDM04	bT	39.8	31.96	2.44	3.9	56	0.04	23.1	0.58	620	0.68
RDM05	bT	36.1	13.89	2.45	4.8	94	0.04	24.6	0.49	175	0.29
RDM06	bT	38.5	19.12	2.62	4.1	120	0.03	21.2	0.34	343	1.08
RDM07	bT	26.6	14.53	2.04	3.8	26	0.06	27.1	0.57	455	0.27
RDM08	bT	30.9	16.56	2.24	4.6	92	0.06	23	0.47	287	0.36
RDM09	bT	29.9	21.37	2.33	4.8	66	0.05	27.1	0.52	255	0.46
RDM10	bT	29.5	20.78	2.51	4.5	24	0.06	28.1	0.56	417	0.38
RDM11	aT	35.7	35.57	2.61	6.3	202	0.03	22.6	0.39	212	0.92
RDM12	bT	48.8	49.27	3.18	5.3	81	0.06	21.8	0.76	308	1.21
RDM13	bT	40.7	25.09	3.31	6.9	33	0.18	34.5	0.85	723	0.81
RDM14	bT?	31.4	26.23	2.99	5.3	36	0.11	28.3	0.64	680	2.46
RDM15-1	aT	38.6	33.15	3.43	5.9	46	0.15	31.1	0.8	884	1.05
RDM15-2	bT	39.3	34.38	3.51	6.7	43	0.25	31.3	0.81	913	0.89
RDN02	bT	24	15.86	1.64	3.2	19	0.06	26.4	0.44	352	0.56
RDN03	aT	21.3	17.52	1.7	2.7	33	0.04	20.7	0.42	321	0.26
RDN04	bT	32.2	19.02	2.21	3.4	117	0.02	17.5	0.35	182	0.42
RDN05	bT	34.6	21.97	2.5	3.7	75	0.04	22.5	0.54	258	0.42
RDN06	bT	27.4	14.59	2	3.9	51	0.05	25.6	0.58	302	0.2
RDN07	aT	27.9	21.99	2.14	3.5	35	0.04	22.2	0.42	474	0.32
RDN08	aT	20.6	23.44	1.97	3.1	32	0.04	25	0.38	467	0.25
RDN09	bT	33.3	18.9	2.27	4.9	32	0.1	24.9	0.57	398	0.3
RDN10	bT	33.6	34.79	2.93	4.9	64	0.05	30.7	0.61	402	0.83
RDN11	bT?	39.9	34.56	3.02	4.8	119	0.04	20.5	0.59	331	1.01
RDN12	bT	39.5	47.87	3.72	6.2	10	0.24	33.8	0.77	484	1.41
RDN13	aT?	24.3	8.8	2.55	6.4	110	0.05	21.5	0.41	208	0.74
RDN14	bT	29.9	14.06	2.36	4.4	87	0.05	20.6	0.5	235	0.78
RDN15	bT	28	16.46	2.45	4.7	72	0.07	21	0.49	341	0.67
RDP02	bT	30.7	18.32	1.98	3.6	44	0.06	24.6	0.55	343	0.25
RDP03	bT	31.5	20.38	2.38	4.7	16	0.11	29.1	0.64	587	0.25
RDP04	bT	33.4	18.48	1.97	3.5	78	0.04	19.9	0.51	178	0.32
RDP05	aT	33	36.31	2.84	3.5	14	0.06	27	0.82	1260	0.21
RDP06	bT	44.1	18.92	2.4	4.4	98	0.04	18.5	0.65	153	0.32
RDP07	bT	30.6	18.27	2.51	4.1	28	0.08	29.8	0.58	402	0.27
RDP08	bT	29	19.88	2.34	4.3	18	0.12	28.8	0.61	662	0.38
RDP09	aT	20.3	21.15	1.81	2.8	24	0.05	21	0.35	680	0.33
RDP10	bT	33.7	20.39	2.79	5.2	67	0.07	24.5	0.52	364	0.52
RDP11	bT	31.3	23.68	2.72	4.9	18	0.14	29.9	0.64	823	0.68

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Cr - Mo) Continued

Sample ID	**Till**	**Cr**	**Cu**	**Fe**	**Ga**	**Hg**	**K**	**La**	**Mg**	**Mn**	**Mo**
	Type	ppm	ppm	%	ppm	ppb	%	ppm	%	ppm	ppm
RDP12	bT	40.9	33.53	3.57	6.2	14	0.19	30.7	0.81	856	0.57
RDP13	bT	34.1	21.18	2.36	4.6	22	0.09	28	0.53	267	0.51
RDP14	aT	32.1	17.96	2.26	3.8	69	0.05	20.2	0.49	318	0.6
RDP15	bT	27.3	12.98	2.12	5.5	62	0.03	22.1	0.32	195	0.49
RDQ02	bT	30.3	14.07	2.3	5.1	33	0.14	30.9	0.62	447	0.32
RDQ03	bT	29.3	15.09	2.26	4.8	12	0.13	33.1	0.65	492	0.27
RDQ04	bT	53.1	35.73	3.17	5.7	39	0.07	34	1.18	378	0.16
RDQ05	bT	30.9	19.21	1.94	3.9	46	0.04	23.3	0.44	630	0.29
RDQ06	bT	32.1	23.45	2.76	4.6	10	0.08	42.1	0.71	535	0.36
RDQ07	aT	28.8	23.34	2.66	5.1	136	0.03	25.7	0.38	197	0.38
RDQ09	bT	24.1	42.67	2.53	3.7	36	0.04	31	0.46	357	1.02
RDQ10	bT	42.2	79.07	4.58	6.1	145	0.03	28.6	0.61	438	2.74
RDQ11	bT	32	24.73	2.45	4.4	20	0.08	26.7	0.62	372	0.75
RDQ12	bT	26	19.79	2.4	4.2	22	0.11	27.4	0.56	641	0.37
RDQ13	bT?	40.8	26.58	2.75	4.8	117	0.04	21.2	0.52	379	0.87
RDQ14	bT	30.9	17.91	2.36	4.7	71	0.06	25	0.48	246	0.57
RDQ15	bT	38.7	16.85	2.92	5.7	75	0.1	22.1	0.6	332	0.51
RDR02	bT	25.3	9.94	1.92	4.6	49	0.07	29.3	0.52	317	0.34
RDR03	bT	32.7	13.5	2.11	4.3	53	0.08	30.7	0.64	343	0.28
RDR04	bT	37.8	27.19	2.59	4.5	17	0.06	37.8	0.92	484	0.14
RDR05	bT?	47.4	23.85	2.76	4.6	49	0.06	27.9	1.03	234	0.14
RDR06	bT?	29.9	28.4	2.86	4.3	60	0.05	39.8	0.54	251	0.42
RDR07	bT	39.8	33.8	3.49	6.3	13	0.22	42.6	0.71	668	0.45
RDR08	bT	24.9	34.06	2.36	4	64	0.05	26.5	0.42	395	0.75
RDR09	bT?	31.6	72.76	3.38	5.4	46	0.04	29.8	0.62	476	1.46
RDR10	bT	28.3	30.34	2.76	5.6	12	0.15	34.4	0.61	639	0.43
RDR11	bT	25	15.98	2.33	4.2	21	0.08	37.9	0.57	367	0.64
RDR12	bT	36.3	26.8	3.02	5.7	65	0.09	27.2	0.71	441	0.82
RDR12FD	bT	35.8	34.33	3.14	6	29	0.11	30.2	0.77	617	0.65
RDR13	bT	32.7	13.29	2.42	6.4	62	0.07	26.4	0.59	318	1.79
RDR14	aTv	37.7	55.32	5.49	7.9	183	0.05	32.6	0.34	1086	3.99
RDR15	bT	39.2	20.91	3.09	6.8	49	0.11	31.9	0.78	397	0.55
RDS02	bT	21.6	5.06	1.76	7.9	77	0.05	23.8	0.22	86	0.44
RDS03	bT	23.1	10.35	1.59	3.9	8	0.1	35.7	0.45	411	0.16
RDS04	bT	27.9	15.08	2.02	4.6	25	0.1	33.1	0.59	399	0.22
RDS05	aT?	39.9	19.39	2.92	5.9	163	0.04	22.6	0.43	209	2.34
RDS06	bT	30.5	49.69	3.35	5.5	57	0.06	40.5	0.63	468	0.62
RDS07	bT	31.9	31.64	3.28	5.7	74	0.09	44.4	0.54	329	0.58
RDS07.5	bT	27.3	33.28	2.61	5	16	0.08	41.7	0.61	440	0.74
RDS08	bT	31.2	31.33	3.02	5.6	22	0.09	46.2	0.69	573	0.61
RDS09	bT	29.9	35.92	3.3	5.8	31	0.08	30.4	0.7	627	0.93
RDS10	bT	31.1	28.16	3.14	6	65	0.05	39.1	0.52	363	2.35
RDS11	bT	37.5	18.96	2.93	6.5	71	0.11	27.9	0.62	412	0.66
RDS12	bT	33.5	20.76	2.72	5.5	50	0.1	29.9	0.67	553	0.62

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Cr - Mo) Continued

Sample ID	Till Type	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppb	K %	La ppm	Mg %	Mn ppm	Mo ppm
RDS12FD	bT	35.6	23.59	2.94	6.1	38	0.13	32.1	0.72	667	0.59
RDS13	bT	30.8	21.38	2.66	5.1	26	0.1	29.9	0.67	494	0.51
RDS14	bT?	27.5	21.19	2.45	4.8	37	0.06	32.5	0.59	387	0.69
RDS15	bT	40.6	26.92	3.35	6.9	15	0.24	33	0.81	766	0.51
RDT02	bT	31.2	6.73	2.27	5.2	23	0.11	25.9	0.65	315	0.2
RDT03	bT	35.5	12.58	2.26	5.6	73	0.09	33.1	0.67	290	0.39
RDT04	aT	45.1	40.26	2.97	5.8	114	0.05	32.5	0.73	332	0.59
RDT05	bT	30.8	32.43	3.07	5.6	82	0.08	39	0.59	400	0.97
RDT06	bT	36.1	22.25	2.93	5.3	27	0.09	40.5	0.77	376	0.35
RDT07	aT	24.5	62.8	2.87	4.4	9	0.07	45.5	0.6	595	0.69
RDT08	aT	37	118.43	3.84	6.1	57	0.05	43.7	0.62	576	1.76
RDT09	bT	27.9	55.4	2.72	4.9	37	0.04	33.8	0.54	371	0.75
RDT9.5	bT	31.9	54.15	3.23	5.5	37	0.07	37.3	0.68	522	1.42
RDT10	bT	32.5	30.51	2.59	4.8	53	0.07	26.6	0.57	341	1.03
RDT11	bT	40.8	43.94	7.55	6.4	119	0.03	23.9	0.39	354	4.65
RDT12	bT	40.4	27.4	3	5.7	47	0.08	32.9	0.68	587	0.93
RDT13	bT	31.4	14.58	2.39	5.1	55	0.07	32.3	0.58	369	0.5
RDT14	bT	33.7	17.29	2.55	5.6	29	0.1	28.6	0.7	514	0.49
RDT15	bT	36.3	22.86	2.92	5.9	35	0.14	33.2	0.73	620	0.5
RDV02a	bT	30.7	21.62	2.54	4.3	18	0.09	30.8	0.69	1223	0.3
RDV02b	bT	26.1	11.1	2.02	4.1	12	0.1	30.2	0.58	359	0.16
RDV03	bT	43.6	20.95	3.15	8.1	24	0.32	37.3	0.87	758	0.44
RDV03FD	bT	40	25.87	3.21	7.8	19	0.34	38.8	0.85	753	0.41
RDV04	bT	34.9	21.03	2.37	5.8	20	0.17	35.9	0.74	677	0.27
RDV05	bT	23.1	17.02	2.08	4.6	12	0.13	35.7	0.53	533	0.31
RDV06	bT	28.6	26.19	2.89	5.8	22	0.14	45.4	0.61	576	0.64
RDV07a	aT?	33.5	26.18	2.56	4.9	61	0.06	38.7	0.59	422	0.39
RDV07b	bT	31.7	33.71	3.12	5.4	30	0.11	46.3	0.67	598	0.37
RDV08	bT	35.4	27.5	3.53	6.5	36	0.13	36.1	0.7	549	0.62
RDV09	bT	30.1	68.8	3.17	5.2	18	0.05	43.4	0.64	542	1.53
RDV10	aT	36.4	58.82	4.33	5.9	164	0.03	22.6	0.4	287	3.62
RDV11	aT?	30.5	16.89	2.59	5.8	79	0.08	25.4	0.46	353	0.78
RDV12	bT	27.3	13.66	2.09	5	55	0.06	28.5	0.53	276	1.12
RDV13	bT	25.1	42.53	2.41	4.6	12	0.13	30.4	0.55	530	0.67
RDV14	bT	43.5	21.67	3.31	6.6	102	0.08	23.7	0.64	341	0.76
RDV15	bT	29.4	19.13	2.26	4.4	56	0.06	30.3	0.54	313	0.51
RDW02	bT	37.6	16.68	2.45	5.6	20	0.11	30.5	0.74	488	0.31
RDW03	bT	30	21.54	2.81	3.7	33	0.07	33.9	0.58	460	0.34
RDW04	bT	31	23.35	3.18	3.7	45	0.06	36.3	0.65	527	0.2
RDW05	bT	28.8	21.43	2.31	5	75	0.05	25.7	0.44	252	0.48
RDW06	bT	37.3	28.61	3.12	7	15	0.19	34.7	0.79	805	0.47
RDW07	aT	32.9	34.56	2.8	4.9	107	0.04	31.8	0.45	320	0.7
RDW08	bT?	32.5	36.36	3.38	6.3	10	0.14	43.8	0.75	811	0.75
RDW09	bT	35.8	29.68	3.09	5.9	44	0.08	29.4	0.53	407	1.14

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Cr - Mo) Continued

Sample ID	Till Type	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo
		ppm	ppm	%	ppm	ppb	%	ppm	%	ppm	ppm
RDW10	bT	28.3	26.45	2.87	6.4	115	0.04	23.5	0.33	240	2.14
RDW11	bT	32.9	33.2	3.2	5.9	13	0.1	41.4	0.72	848	1.24
RDW12	bT	35.3	23.74	2.57	6.1	65	0.09	24.5	0.6	384	0.78
RDW13	bT	36.7	21.6	2.83	5.7	60	0.08	26.2	0.68	383	0.84
RDW14	bT	37.4	20.57	2.67	6.1	61	0.07	21.2	0.58	348	0.53
RDW15	bT	33	14.94	2.35	5.1	10	0.06	35.3	0.69	406	0.37
RDX02	bT	27.5	9.17	1.93	4.6	34	0.08	26.9	0.47	358	0.32
RDX03	bT	29.5	19.94	2.46	5.3	17	0.13	32.6	0.66	662	0.41
RDX04	bT?	44.4	23.5	3.11	6.2	106	0.08	24.8	0.85	443	0.36
RDX05	bT?	31.1	18.31	2.46	5.8	28	0.14	31.9	0.7	646	0.33
RDX06	bT	26.8	49.01	2.84	5.3	16	0.11	38.2	0.58	783	0.91
RDX07	bT	32.7	16.95	3.14	7.7	48	0.17	28.9	0.67	570	0.73
RDX08	bT	33.8	22.93	3.11	6	17	0.19	33.3	0.69	660	3.57
RDX09	aT	35.6	57.73	3.7	5.8	117	0.08	41.8	0.61	438	2.37
RDX10a	aT	22.6	41.33	2.71	3.6	27	0.04	27.5	0.42	692	1.39
RDX10b	aT	26.7	43.28	3.13	5.1	10	0.06	37	0.57	731	1.7
RDX11	bT	34.4	52.85	3.68	6.5	11	0.11	32	0.74	668	2.8
RDX12-1	aT?	35.3	16.67	4.11	8.2	94	0.04	16.4	0.42	347	2.17
RDX12-2	aT?	36.1	21.95	3.52	6.3	165	0.04	16.1	0.45	358	3.84
RDX13	bT	29.7	21	2.78	6.4	60	0.06	20.3	0.56	378	1.54
RDX14	bT	34.8	29.22	2.72	5.8	63	0.11	21.7	0.66	432	0.83
RDX15	bT	28.9	30.87	2.22	4.3	39	0.05	19.6	0.54	375	0.42

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Na – Te)

Sample ID	Till Type	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te
		%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm
RDA02	bT	0.008	27.6	0.032	7.53	0.01	0.4	3.6	0.1	4	< .02
RDA03-1	aT	0.003	28.6	0.023	8.17	0.02	0.29	2.9	0.4	3.4	< .02
RDA03-2	aT	0.003	28.6	0.028	10.15	< .01	0.39	3.7	0.2	3.8	< .02
RDA04	bT	0.004	33.1	0.061	9.33	0.01	0.45	3.6	< .1	8.9	< .02
RDB02	bT	0.003	39.1	0.035	9.12	< .01	0.4	3.2	0.2	5.1	< .02
RDB03	bT	0.003	35.9	0.048	7.61	< .01	0.23	2	0.3	9.3	< .02
RDB04	bT	0.003	29.6	0.053	8.33	< .01	0.33	2.1	0.3	6.4	< .02
RDB05	bT	0.003	25.2	0.05	9.06	< .01	0.46	2.4	0.2	4	< .02
RDB06	bT	0.003	33	0.027	8.28	< .01	0.24	3.1	0.1	10.3	< .02
RDB13	bT	0.004	31.8	0.017	7.67	< .01	0.43	2.3	0.4	3.7	0.02
RDB14	bT	0.002	39.8	0.051	10.36	0.01	0.47	2.1	0.3	3.5	0.02
RDB15	bT	0.005	33.1	0.036	12.43	< .01	0.52	2.2	0.2	6.2	< .02
RDC02	aT	0.003	43.9	0.043	11.32	0.02	0.39	2.6	0.7	3.5	0.02
RDC03	bT	0.004	35.9	0.043	11.33	0.01	0.48	4	0.1	10.1	0.02
RDC04	bT	0.003	30.1	0.035	6.17	0.01	0.22	2.3	0.3	4.1	< .02
RDC05	bT	0.003	45.8	0.041	10.06	0.01	0.33	2.3	0.5	3.8	0.02

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Na – Te) Continued

Sample ID	**Till**	**Na**	**Ni**	**P**	**Pb**	**S**	**Sb**	**Sc**	**Se**	**Sr**	**Te**
	Type	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm
RDC06	bT	0.003	34	0.049	8.31	0.01	0.35	2.4	0.8	3.4	0.02
RDC07	aT	0.003	26.5	0.053	9.57	0.01	0.46	3.5	0.4	3.1	< .02
RDC12	bT	0.004	32.2	0.046	6.75	0.02	0.3	2	0.3	5.5	< .02
RDC13	bT	0.003	35.8	0.042	9.55	0.01	0.23	1.6	0.3	7.8	0.02
RDC14	bT	0.003	32.2	0.015	8.02	< .01	0.27	2.1	0.2	4.3	< .02
RDC15	bT	0.006	26.4	0.024	10.22	0.01	0.45	1.6	0.2	3.3	0.02
RDCD11	bT	0.004	35.9	0.033	11.53	< .01	0.69	3.1	0.3	4.7	0.02
RDD02	aT	0.003	26.3	0.035	8.02	0.02	0.3	2.5	0.4	3.2	< .02
RDD03	bT	0.004	33	0.036	7.55	0.01	0.28	3.2	0.2	7.1	< .02
RDD04	bT	0.003	25.1	0.021	6.56	0.01	0.22	2.2	0.2	3.6	< .02
RDD05	aT	0.003	37.3	0.053	12.87	0.01	0.49	4	0.7	3.9	0.02
RDD06	bT	0.005	35.8	0.037	12.33	< .01	0.46	4.1	0.3	5.4	0.03
RDD07	bT	0.006	36.7	0.047	11.33	< .01	0.64	4	0.1	8.5	0.02
RDD08	aT	0.003	26.8	0.057	9.83	0.02	0.33	3.3	0.4	3.2	0.02
RDD09	bT	0.005	29.9	0.045	12.29	< .01	0.77	3.6	0.4	5.3	0.03
RDD10	bT	0.004	31.1	0.052	11.76	< .01	0.62	3.8	0.2	5.7	< .02
RDD12	bT	0.003	36.7	0.04	12.27	< .01	0.5	2.2	0.3	3.2	0.02
RDD13-1	bT	0.004	29.8	0.028	7.53	< .01	0.37	2.3	0.3	3.7	< .02
RDD13-2	bT	0.004	38	0.041	15.16	< .01	0.71	3.2	0.2	5.5	< .02
RDD14	bT	0.006	26.3	0.032	11.58	< .01	0.57	2.5	0.5	4	0.02
RDD15	bT	0.007	45	0.03	13.18	< .01	0.45	4	0.3	21.7	0.02
RDE02	bT	0.003	24.2	0.089	9	0.01	0.39	1.9	0.7	4.3	0.02
RDE03	bT	0.003	28.3	0.039	8.46	< .01	0.34	2.4	0.1	3.8	0.02
RDE04	bT	0.003	37.4	0.049	6.35	< .01	0.27	1.9	0.1	5.5	0.02
RDE05	bT	0.005	48.4	0.041	14.31	< .01	0.6	3.9	0.3	5.5	0.04
RDE07	bT	0.004	37.8	0.034	13.98	0.02	0.14	2.8	0.6	4.3	< .02
RDE08	bT	0.004	35	0.058	7.8	0.01	0.26	2.1	0.8	7	< .02
RDE09	bT	0.004	29.7	0.025	12.32	< .01	0.36	4.2	0.5	4	< .02
RDE10	bT	0.004	31.6	0.018	8.71	0.01	0.36	2.8	< .1	6.6	0.02
RDE11	bT	0.005	42.8	0.04	13.63	< .01	0.49	3.6	0.4	6.7	0.03
RDE12	aT	0.004	35.9	0.046	17.01	0.01	0.48	3.2	1	6	0.03
RDE13	bT	0.003	35.9	0.054	6.91	0.01	0.33	2.2	0.6	6.5	< .02
RDE14	bT	0.003	36.6	0.032	10.02	0.01	0.46	2.2	0.5	4.4	0.03
RDE15	bT	0.005	36.8	0.039	9.98	0.02	0.53	2.9	0.2	3.9	< .02
RDEF06	bT	0.005	34.9	0.036	10.66	< .01	0.39	4.2	0.3	3.9	< .02
RDF02	aT	0.003	26.9	0.051	10.05	< .01	0.55	2.1	0.3	4.1	0.03
RDF03	bT	0.005	29.1	0.052	9.63	0.01	0.4	2.7	0.2	4.1	< .02
RDF04	bT	0.003	24.9	0.051	9.63	< .01	0.48	2.9	0.3	3.6	0.02
RDF05	bT	0.005	30.6	0.051	9.82	< .01	0.45	3.2	0.5	4.8	0.03
RDF07	bT	0.004	31.9	0.057	10.74	< .01	0.53	3.1	0.3	5.3	0.02
RDF08	bT	0.004	32.7	0.044	8.77	0.02	0.28	2.6	0.5	5.7	< .02
RDF09	bT	0.005	44.8	0.056	15.21	0.01	0.59	3.7	0.2	4.6	0.03
RDF10	bT	0.003	31.2	0.038	10.61	< .01	0.29	2.4	0.1	3.4	0.02
RDF11	aT	0.006	56.1	0.059	17.73	0.01	0.52	4.3	0.2	6.3	0.02

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Na – Te) Continued

Sample ID	**Till Type**	**Na** %	**Ni** ppm	**P** %	**Pb** ppm	**S** %	**Sb** ppm	**Sc** ppm	**Se** ppm	**Sr** ppm	**Te** ppm
RDF12	bT	0.003	18.4	0.07	11.25	0.03	0.25	1.5	0.3	9.8	0.02
RDF13	aT	0.003	47	0.027	8.19	0.01	0.27	2.3	0.4	3.6	0.03
RDF14	bT	0.005	41.7	0.076	10.91	0.01	0.57	2.8	0.4	4	0.03
RDF15	bT	0.004	31.7	0.031	8.42	0.02	0.43	2.5	0.1	3.6	< .02
RDG02	bT	0.005	29.1	0.061	9.1	< .01	0.52	2.9	0.1	4.5	0.02
RDG03	bT	0.004	30.3	0.05	8.22	0.01	0.39	2.8	0.3	5.7	< .02
RDG04	bT	0.006	41.8	0.078	9.76	< .01	0.4	3.3	0.4	17.8	< .02
RDG05	bT?	0.004	56.5	0.06	18.51	< .01	0.34	3.9	0.5	13.5	0.02
RDG06	aT	0.004	38.8	0.04	11.89	0.01	0.48	2.9	0.7	3.8	0.03
RDG07	bT?	0.006	35.6	0.047	10.27	0.01	0.54	3.3	0.4	3.5	< .02
RDG08	bT	0.003	38.8	0.045	12.12	0.02	0.49	2.8	0.5	3.3	0.02
RDG09	bT	0.005	36.8	0.047	10.22	0.01	0.49	3.6	< .1	6.1	0.03
RDG10	aT	0.004	33	0.041	8.05	0.02	0.29	2.2	0.4	3.6	< .02
RDG11	aT?	0.003	46.4	0.075	13.81	0.01	0.4	1.9	0.4	3.5	< .02
RDG12	bT	0.009	47.7	0.049	15.43	< .01	0.87	4.5	< .1	16.5	< .02
RDG12FD	bT	0.007	44.4	0.042	13.22	0.01	0.68	4	0.4	5.2	0.02
RDG13	bT	0.007	37	0.044	13.02	< .01	0.58	3.5	0.3	8.2	< .02
RDG14a	aT	0.003	27.1	0.142	14.68	0.08	0.35	2.7	1.8	3.2	0.03
RDG14b	bT	0.005	38	0.033	13.02	< .01	0.64	4.3	0.1	6.8	0.02
RDG15	aT	0.004	43.8	0.037	16.97	0.02	0.66	2.9	0.3	4.1	0.03
RDH02	bT	0.004	27	0.048	7.33	0.01	0.48	2.6	< .1	7	< .02
RDH03	aT	0.004	24.2	0.037	6.91	0.01	0.41	2.1	0.2	3.3	< .02
RDH04	aT	0.004	35.1	0.129	16.99	0.06	0.52	3.3	2.3	5.4	0.02
RDH05	bT?	0.004	52.5	0.089	8.93	0.02	0.41	2.5	0.7	12.9	< .02
RDH06	bT	0.004	58.4	0.069	15.22	< .01	0.52	4.5	< .1	12.6	0.02
RDH07	bT	0.003	27.6	0.038	8.82	0.02	0.22	2.1	0.4	7.3	< .02
RDH08	bT	0.003	20.7	0.059	6.31	0.02	0.22	1.7	0.4	2.9	< .02
RDH09	bT	0.004	32.7	0.059	8.54	< .01	0.37	3.1	< .1	12.7	< .02
RDH10	?	0.004	35.3	0.065	18.67	< .01	0.24	2.5	< .1	12.5	0.03
RDH11	bT	0.003	32.4	0.026	10.71	< .01	0.4	2.8	0.3	3.4	< .02
RDH12	bT	0.004	30.9	0.035	6.72	0.01	0.24	2.5	0.2	4.1	< .02
RDH13	bT	0.004	37.4	0.041	11.99	< .01	0.57	3.1	0.1	4.8	0.02
RDH14.5	bT	0.004	33.4	0.033	10.44	< .01	0.38	2.4	0.2	5.1	< .02
RDK02	bT	0.003	34.6	0.06	10.84	0.01	0.48	2.3	0.4	3.9	< .02
RDK03	bT	0.004	21.8	0.025	9.39	0.01	0.37	2.5	0.4	2.7	< .02
RDK04	bT	0.004	44.1	0.053	10.73	< .01	0.58	3.4	< .1	4	0.03
RDK05	bT	0.003	21.9	0.032	6.67	< .01	0.27	1.9	< .1	2.9	< .02
RDK06	aT	0.004	29.5	0.087	9.74	0.01	0.41	3.6	< .1	13.1	< .02
RDK07	aT	0.003	35.5	0.075	6.81	0.01	0.16	1.5	0.2	12.9	< .02
RDK08	bT	0.004	42.9	0.038	11.96	0.01	0.38	2.8	0.5	4.6	0.02
RDK09	bT	0.003	27	0.055	8.84	0.01	0.28	1.4	0.2	6.6	< .02
RDK10	bT	0.003	29.4	0.029	8.51	0.01	0.19	1.8	0.3	4.6	0.02
RDK11	bT	0.006	36.3	0.053	9.62	< .01	0.49	3.8	0.1	13.9	< .02
RDK12	aT?	0.003	38.6	0.044	16.16	0.01	0.39	2.6	0.4	4	0.02

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Na – Te) Continued

Sample ID	**Till**	**Na**	**Ni**	**P**	**Pb**	**S**	**Sb**	**Sc**	**Se**	**Sr**	**Te**
	Type	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm
RDK13	bT	0.003	24.9	0.043	15.46	0.02	0.42	2.4	1.2	3.3	0.08
RDK14	bT?	0.003	25.9	0.031	7.56	0.01	0.18	2	0.6	3.8	< .02
RDK15	bT	0.014	32.4	0.038	7.01	0.02	0.25	1.9	0.6	4.5	< .02
RDL02	aT	0.004	39	0.061	11.68	0.02	0.38	2.7	1.5	3.5	0.02
RDL03	bT	0.004	41.5	0.037	9.26	< .01	0.36	2.5	0.7	4.5	< .02
RDL04	bT	0.004	39.6	0.04	10.67	0.01	0.37	3	0.6	3.9	0.02
RDL05	bT	0.022	37.6	0.044	10.15	0.01	0.25	3.2	0.5	8.8	< .02
RDL06	aT	0.003	24.7	0.077	11.26	0.02	0.32	2.3	0.7	3.6	< .02
RDL07	bT	0.003	25.3	0.027	6.47	< .01	0.15	1.5	< .1	10.1	< .02
RDL08	bT	0.004	35.6	0.045	10.62	0.02	0.33	2.7	0.3	4.6	< .02
RDL09	bT	0.005	38.1	0.054	11.6	< .01	0.4	3	< .1	5.4	0.02
RDL10	aT	0.003	35.5	0.029	10.48	0.02	0.45	3.4	0.4	3.4	0.03
RDL11a	aT	0.003	32	0.069	16.62	0.01	0.54	2.6	0.6	4.7	0.02
RDL11b	aT	0.005	38.3	0.08	17.03	< .01	0.56	3.9	0.5	13	0.02
RDL12	aT	0.003	28.2	0.064	12.18	0.01	0.48	2.5	0.8	3.4	0.02
RDL13	aT	0.003	20.1	0.137	26.88	0.07	0.34	1.8	1.1	19.4	0.07
RDL14	bT	0.005	43.6	0.063	11.3	< .01	0.53	3.7	0.2	6.6	0.02
RDL15	bT	0.011	51.1	0.076	19.82	< .01	0.77	4.6	0.2	23.7	0.02
RDM02	aT	0.003	47.1	0.055	14.25	0.01	0.52	2.2	0.7	4.7	0.03
RDM03	bT	0.005	37.8	0.035	13.62	0.01	0.26	2.7	0.4	14.1	< .02
RDM03FD	bT	0.005	36.3	0.05	9.89	0.01	0.26	2.7	< .1	13.5	< .02
RDM04	bT	0.006	40.6	0.066	14.73	0.01	0.52	2.8	< .1	6	0.03
RDM05	bT	0.004	27.5	0.069	8.12	0.01	0.22	2.1	0.4	9.6	< .02
RDM06	bT	0.003	23.7	0.077	11.96	0.02	0.44	3	0.8	3.3	< .02
RDM07	bT	0.004	27.9	0.07	8.78	0.01	0.3	1.8	0.3	9.9	0.02
RDM08	bT	0.004	25.5	0.04	9.36	0.02	0.34	2.4	0.3	3	< .02
RDM09	bT	0.004	29.6	0.032	13.12	0.01	0.26	2	0.2	3.4	< .02
RDM10	bT	0.006	33.5	0.04	12.75	< .01	0.38	3.5	0.2	4.9	< .02
RDM11	aT	0.004	28.2	0.034	19.05	0.04	0.25	3.1	1.2	3.1	0.02
RDM12	bT	0.004	51.4	0.043	13.02	0.02	0.47	3	0.8	4.7	0.05
RDM13	bT	0.006	44.8	0.046	13.8	0.01	0.64	4	< .1	5.4	< .02
RDM14	bT?	0.005	43.6	0.048	11.17	< .01	0.47	2.5	0.3	5.2	< .02
RDM15-1	aT	0.007	49.5	0.064	18.79	< .01	0.58	3.4	0.8	4.8	0.04
RDM15-2	bT	0.007	46.9	0.069	16.77	< .01	0.75	4.5	0.4	11.3	0.03
RDN02	bT	0.004	25.6	0.082	9.61	0.01	0.52	2.1	< .1	9.4	< .02
RDN03	aT	0.003	24.5	0.059	8.22	0.01	0.4	1.8	0.2	3.8	< .02
RDN04	bT	0.003	30	0.038	15.4	0.01	0.39	2.3	0.9	3	< .02
RDN05	bT	0.003	36.8	0.052	12.22	0.02	0.42	2	0.3	2.8	< .02
RDN06	bT	0.003	26.8	0.036	7.82	0.01	0.26	2	0.4	3.2	< .02
RDN07	aT	0.003	31.4	0.061	13.19	0.02	0.41	2.4	0.5	3.3	0.02
RDN08	aT	0.004	23.7	0.057	14.11	< .01	0.44	2.6	0.1	4	0.03
RDN09	bT	0.005	33.2	0.039	9.55	< .01	0.33	3	0.1	3.6	< .02
RDN10	bT	0.004	35	0.042	15.28	0.01	0.53	2.4	0.6	4	0.03
RDN11	bT?	0.004	44.5	0.05	16.39	0.02	0.7	3	1.4	3.6	0.04

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Na – Te) Continued

Sample ID	Till	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te
	Type	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm
RDN12	bT	0.006	41	0.049	13.23	< .01	0.18	4	0.5	6.3	0.05
RDN13	aT?	0.003	16.5	0.048	21.06	0.04	0.16	1.6	0.7	2.1	< .02
RDN14	bT	0.003	29.2	0.039	11.31	< .01	0.35	2.1	0.8	3.3	0.02
RDN15	bT	0.006	27.4	0.057	14.51	< .01	0.29	2.2	0.9	2.7	< .02
RDP02	bT	0.006	27.9	0.06	9.78	< .01	0.57	2.1	0.7	3.6	< .02
RDP03	bT	0.005	30.5	0.056	10.86	< .01	0.47	3.4	0.5	4.1	< .02
RDP04	bT	0.004	29	0.033	9.67	0.01	0.31	2.2	0.5	2.3	< .02
RDP05	aT	0.005	38.1	0.104	20.89	< .01	0.43	3.3	< .1	7.7	0.02
RDP06	bT	0.003	35.5	0.045	8.24	0.02	0.14	2.4	1	2.2	< .02
RDP07	bT	0.005	27.9	0.045	10.8	< .01	0.34	2.2	0.6	3.4	< .02
RDP08	bT	0.006	30.1	0.051	12.63	< .01	0.39	2.9	0.1	4.5	< .02
RDP09	aT	0.003	23	0.052	13.21	< .01	0.42	2.1	0.2	4.1	< .02
RDP10	bT	0.005	29.3	0.055	10.31	0.01	0.28	2.3	0.8	2.9	< .02
RDP11	bT	0.008	33.1	0.051	11.74	< .01	0.41	3.7	0.5	11.6	0.02
RDP12	bT	0.008	44.6	0.058	14.31	< .01	0.66	4.2	< .1	5	< .02
RDP13	bT	0.005	28	0.036	9.25	0.02	0.21	2.5	0.4	3.4	< .02
RDP14	aT	0.004	30.2	0.039	12	0.01	0.34	2.3	0.9	2.7	< .02
RDP15	bT	0.004	16.6	0.039	8.57	0.02	0.23	2.3	0.7	2.2	< .02
RDQ02	bT	0.006	26	0.051	9.9	0.01	0.39	2.7	0.6	4.3	< .02
RDQ03	bT	0.007	26	0.061	9.62	< .01	0.41	3	0.2	6.4	< .02
RDQ04	bT	0.004	53.8	0.065	14.8	0.01	0.24	3.3	0.2	4.4	< .02
RDQ05	bT	0.005	23.8	0.054	13.35	< .01	0.31	2.4	0.9	5.3	< .02
RDQ06	bT	0.006	32.7	0.027	10.35	< .01	0.51	3.1	0.2	7.9	< .02
RDQ07	aT	0.006	20	0.045	12.66	0.02	0.47	2.2	0.7	2.5	0.02
RDQ09	bT	0.003	33.8	0.049	12.45	0.01	0.29	1.7	0.7	3.3	0.06
RDQ10	bT	0.003	44.5	0.05	25.83	0.02	0.61	2.7	2.1	2.6	0.09
RDQ11	bT	0.004	41.2	0.06	9.08	< .01	0.28	2.8	< .1	4.9	0.02
RDQ12	bT	0.006	28.4	0.056	10.27	0.01	0.44	3.1	0.3	6.4	0.02
RDQ13	bT?	0.003	36.1	0.051	14.21	0.03	0.37	3	1.2	2.9	< .02
RDQ14	bT	0.003	25.1	0.038	8.03	0.02	0.24	2.2	0.3	3	< .02
RDQ15	bT	0.005	33.5	0.088	9.82	0.02	0.3	2.7	0.6	4.5	0.02
RDR02	bT	0.004	21.3	0.051	7.89	0.01	0.28	2.1	0.2	3.6	< .02
RDR03	bT	0.006	31.6	0.065	10.09	0.01	0.31	2.1	0.4	4.4	< .02
RDR04	bT	0.006	39.4	0.056	10.97	< .01	0.37	3.6	0.4	7.2	< .02
RDR05	bT?	0.004	46.2	0.074	13.55	0.01	0.23	2.3	0.3	2.2	0.02
RDR06	bT?	0.004	32.6	0.043	12.79	0.01	0.65	1.9	0.2	3.3	0.02
RDR07	bT	0.017	37.7	0.055	16.62	0.01	1.08	4.1	< .1	27.6	0.02
RDR08	bT	0.004	27.6	0.045	13.72	0.01	0.72	2.6	0.5	2.9	0.03
RDR09	bT?	0.004	52.2	0.049	17.42	0.02	0.57	2	0.3	4.3	0.06
RDR10	bT	0.01	32.4	0.05	10.89	< .01	0.42	3.7	< .1	4.4	0.03
RDR11	bT	0.006	28.2	0.044	6.43	< .01	0.2	2.8	< .1	9.5	< .02
RDR12	bT	0.005	44	0.054	11.39	0.01	0.4	2.4	0.5	4.3	0.03
RDR12FD	bT	0.007	43.7	0.043	11.75	< .01	0.41	3.3	0.2	4.9	0.02
RDR13	bT	0.004	27.8	0.047	5.71	0.01	0.31	1.7	0.5	4.6	< .02

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Na – Te) Continued

Sample ID	Till	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te
	Type	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm
RDR14	aTv	0.004	19	0.138	20.21	0.05	1.43	3	1.9	3.7	0.08
RDR15	bT	0.006	37.9	0.03	15.83	< .01	0.43	3.4	0.4	4.7	0.03
RDS02	bT	0.004	8.3	0.014	9.33	0.02	0.36	1.9	0.4	2.9	< .02
RDS03	bT	0.006	22.4	0.062	8.58	< .01	0.61	3	< .1	6.1	< .02
RDS04	bT	0.006	26.5	0.06	10.2	0.01	0.39	2.8	0.2	4.9	0.02
RDS05	aT?	0.003	25.6	0.082	16.36	0.04	1.71	2.3	1.2	3.1	0.02
RDS06	bT	0.003	37.4	0.041	28.34	< .01	1.02	1.9	0.5	3.4	0.03
RDS07	bT	0.004	34.6	0.041	18.32	0.01	0.62	2.2	0.7	3.9	0.04
RDS07.5	bT	0.005	40	0.075	15.21	< .01	0.75	2.9	0.2	5.9	0.03
RDS08	bT	0.006	38.4	0.073	15.38	< .01	0.85	2.6	0.2	6.1	0.03
RDS09	bT	0.005	38.1	0.041	13	< .01	0.35	2.2	0.1	4	0.05
RDS10	bT	0.004	41.8	0.047	17.87	0.02	0.3	1.7	0.7	5.1	0.03
RDS11	bT	0.005	32.2	0.036	10.73	0.02	0.38	2.5	0.5	4.7	< .02
RDS12	bT	0.006	34.2	0.043	10.28	0.01	0.37	2.6	0.5	4.8	0.03
RDS12FD	bT	0.007	38.1	0.042	11.26	0.01	0.41	3.3	0.4	5.3	0.02
RDS13	bT	0.007	32.3	0.034	8.99	< .01	0.45	2.5	0.3	5.7	0.02
RDS14	bT?	0.005	26.9	0.021	11.5	0.01	0.48	2.4	0.4	4.1	< .02
RDS15	bT	0.012	43.6	0.057	13.62	< .01	0.67	4.5	< .1	15.5	0.03
RDT02	bT	0.005	33	0.064	10.76	< .01	3.81	2.3	0.2	10.2	< .02
RDT03	bT	0.006	31.9	0.05	11.18	< .01	0.74	2.8	0.4	4.7	< .02
RDT04	aT	0.003	41.6	0.043	27.25	0.03	1.74	3.2	0.7	3.6	0.05
RDT05	bT	0.003	32	0.039	22.45	0.02	0.85	2.2	0.6	3.8	0.04
RDT06	bT	0.005	40.3	0.056	11.53	< .01	0.48	2	0.1	6.7	< .02
RDT07	aT	0.004	36.9	0.084	24.79	< .01	1.32	2.6	< .1	6.7	0.03
RDT08	aT	0.004	60.1	0.064	39.25	< .01	1.22	2.9	0.3	3.2	0.06
RDT09	bT	0.004	40.1	0.047	17.63	0.02	0.59	2.5	0.5	3	0.03
RDT9.5	bT	0.003	48.6	0.059	15.5	< .01	0.42	2.1	0.4	3.8	0.04
RDT10	bT	0.004	38.8	0.057	15.01	< .01	0.44	2.2	0.5	5.4	0.03
RDT11	bT	0.003	18.6	0.141	72.35	0.06	3.87	1.6	2.4	4.7	0.06
RDT12	bT	0.005	40	0.052	18.97	0.01	0.98	3	0.2	5.4	0.03
RDT13	bT	0.005	28.6	0.031	13.32	< .01	0.56	2	0.1	4.6	0.02
RDT14	bT	0.005	32.5	0.023	11.94	< .01	0.39	2.2	0.3	5.7	0.03
RDT15	bT	0.007	37.9	0.04	13.69	< .01	0.54	3.2	0.7	5	0.03
RDV02a	bT	0.004	39.7	0.084	30.02	0.01	6.2	2.3	0.2	8.4	0.03
RDV02b	bT	0.004	26.7	0.066	9.36	< .01	5.34	2.6	< .1	8.7	0.03
RDV03	bT	0.01	39.8	0.061	13.13	< .01	1.13	4.7	< .1	9	0.02
RDV03FD	bT	0.007	38.4	0.072	12.16	< .01	1.22	5.1	0.2	8.9	0.02
RDV04	bT	0.007	33.8	0.063	12.24	< .01	0.74	3.6	0.4	6.8	< .02
RDV05	bT	0.005	24.9	0.066	9.54	< .01	0.52	2.8	0.6	5.5	< .02
RDV06	bT	0.009	30.5	0.033	17.35	< .01	0.88	3.1	0.4	5	0.04
RDV07a	aT?	0.005	31.5	0.044	16.86	< .01	0.53	2.7	0.4	4.3	0.03
RDV07b	bT	0.006	37	0.039	36.05	< .01	0.64	2.5	0.1	4.6	0.04
RDV08	bT	0.005	37.8	0.038	24.34	0.01	0.45	2.3	0.5	5.2	0.02
RDV09	bT	0.004	42.9	0.068	34.96	< .01	0.68	2.2	0.6	5.6	0.04

APPENDIX 4a: Geochemical results from ICP-MS analysis of till samples (Na – Te) Continued

Sample ID	Till Type	Na %	Ni ppm	P %	Pb ppm	S %	Sb ppm	Sc ppm	Se ppm	Sr ppm	Te ppm
RDV10	aT	0.003	26.2	0.075	19.69	0.03	0.76	1.9	2.2	2.8	0.06
RDV11	aT?	0.003	28.3	0.069	14.86	0.01	0.34	2	1	3.5	0.02
RDV12	bT	0.005	30.1	0.071	8.96	< .01	0.75	2	0.5	6.5	0.02
RDV13	bT	0.008	30.4	0.057	11.23	< .01	0.61	3.3	0.3	6.7	0.05
RDV14	bT	0.004	34.9	0.03	14.27	0.01	0.48	2.8	1.1	3.5	0.02
RDV15	bT	0.004	28.6	0.035	11.56	< .01	0.44	2.2	0.6	3.8	< .02
RDW02	bT	0.004	34.1	0.034	10.26	< .01	0.44	3.1	0.8	5.2	< .02
RDW03	bT	0.003	50.1	0.087	15.02	< .01	0.93	2.2	0.9	9.7	< .02
RDW04	bT	0.01	53.6	0.069	14.84	< .01	0.56	3.5	0.7	8.8	0.04
RDW05	bT	0.004	22.5	0.045	20.51	0.02	0.4	1.9	0.3	3	0.02
RDW06	bT	0.007	36.5	0.045	20.05	< .01	0.59	4.2	< .1	6	0.02
RDW07	aT	0.003	28.8	0.039	34.15	0.03	0.57	2.3	0.6	2.8	0.02
RDW08	bT?	0.006	36.2	0.072	24.45	< .01	0.83	3.8	0.1	9.6	0.04
RDW09	bT	0.004	33.1	0.031	18.09	0.01	0.33	2.3	0.8	2.9	0.03
RDW10	bT	0.003	18.9	0.048	26.28	0.03	0.25	1.6	1.8	2.6	0.03
RDW11	bT	0.006	38.4	0.052	20.22	< .01	1.09	3.2	0.6	10.4	0.02
RDW12	bT	0.005	33	0.032	18.85	< .01	0.77	3.2	1	4	0.02
RDW13	bT	0.004	37.9	0.035	14.43	0.01	0.43	2.2	0.9	3.9	0.02
RDW14	bT	0.004	28.5	0.058	12.07	0.01	0.35	2.7	0.7	3.6	< .02
RDW15	bT	0.005	30	0.026	10.9	< .01	0.29	3	< .1	10	< .02
RDX02	bT	0.004	23.1	0.04	11.84	0.01	0.47	2.2	0.1	4.8	< .02
RDX03	bT	0.005	34.4	0.054	13.7	< .01	0.64	3.7	0.3	5.2	< .02
RDX04	bT?	0.006	48.8	0.047	15.06	< .01	0.91	3.8	0.8	4.8	0.02
RDX05	bT?	0.006	30.3	0.031	13.88	< .01	0.5	3.3	0.7	4.3	< .02
RDX06	bT	0.005	33.4	0.072	30.87	< .01	0.84	2.8	0.7	7.3	0.03
RDX07	bT	0.004	32	0.043	19.08	0.01	0.28	2.3	1	4.7	0.02
RDX08	bT	0.006	38	0.055	20.37	< .01	0.65	3.6	0.5	9.7	0.02
RDX09	aT	0.004	41.4	0.067	87.55	0.01	8.62	1.7	1.2	4.4	0.05
RDX10a	aT	0.003	35.3	0.066	38.23	< .01	3.71	1.9	1	5.1	0.04
RDX10b	aT	0.004	34.3	0.075	30.45	< .01	2.83	3	< .1	6.8	0.04
RDX11	bT	0.011	49.8	0.057	27.17	< .01	2.15	3.3	1	4.8	0.04
RDX12-1	aT?	0.003	21.5	0.066	16.44	0.04	0.59	2.4	2	3.4	0.05
RDX12-2	aT?	0.003	28.3	0.046	19.61	0.02	0.74	2.3	2.2	3	0.05
RDX13	bT	0.004	29.3	0.033	13.82	< .01	0.7	3.2	1.3	3.5	0.04
RDX14	bT	0.004	36.3	0.033	16.7	< .01	0.55	3	1.1	3.8	0.02
RDX15	bT	0.005	27.3	0.047	10.11	< .01	0.41	2.8	0.9	4.2	< .02

APPENDIX 4a: Geochemical results from ICP-MS analysis (Th – Zn)

Sample ID	Till Type	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
RDA02	bT	7.1	0.074	0.06	0.8	30	0.2	39.8
RDA03-1	aT	5.8	0.051	0.08	0.8	34	0.2	35.5
RDA03-2	aT	6.5	0.064	0.09	1.1	34	0.2	36.1
RDA04	bT	8.1	0.085	0.07	1.6	33	0.2	53.2
RDB02	bT	7.2	0.071	0.07	0.9	32	0.1	50
RDB03	bT	5.3	0.057	0.06	0.9	29	0.1	39.5
RDB04	bT	5.5	0.063	0.06	0.7	27	0.3	33.8
RDB05	bT	6.2	0.078	0.06	0.8	30	0.3	33.8
RDB06	bT	6.3	0.059	0.06	1.6	29	0.2	38.7
RDB13	bT	6.3	0.034	0.08	0.5	25	0.2	50.7
RDB14	bT	5.7	0.037	0.06	0.6	29	0.2	51.3
RDB15	bT	7.4	0.043	0.05	0.7	26	0.1	48.7
RDC02	aT	5.5	0.04	0.08	0.7	31	0.2	57.5
RDC03	bT	7	0.079	0.08	0.6	34	0.1	51.2
RDC04	bT	4.3	0.042	0.07	0.6	29	0.1	45.8
RDC05	bT	5.6	0.031	0.06	0.6	25	0.1	53.4
RDC06	bT	4.9	0.025	0.11	0.7	29	0.3	58.3
RDC07	aT	5.2	0.052	0.07	0.7	32	0.3	37.6
RDC12	bT	4.2	0.031	0.08	0.8	28	0.2	64.3
RDC13	bT	5.1	0.028	0.05	0.5	24	0.1	37.3
RDC14	bT	5.8	0.024	0.07	0.6	28	0.1	50.9
RDC15	bT	3.8	0.027	0.05	0.5	24	0.1	53
RDCD11	bT	7.6	0.064	0.08	0.7	33	0.2	56.8
RDD02	aT	5.2	0.053	0.09	0.8	28	0.2	40.9
RDD03	bT	7	0.072	0.05	1.1	30	0.1	42.6
RDD04	bT	6	0.05	0.06	0.6	25	< .1	35
RDD05	aT	6.8	0.083	0.08	0.7	37	0.3	51.7
RDD06	bT	9.4	0.109	0.15	1.1	41	0.2	53.8
RDD07	bT	7.9	0.093	0.1	0.7	39	0.2	53.7
RDD08	aT	6.5	0.053	0.09	0.9	34	0.4	43.4
RDD09	bT	7.3	0.078	0.07	0.7	28	0.3	43.4
RDD10	bT	7	0.084	0.07	0.7	31	0.3	43.2
RDD12	bT	6.9	0.047	0.06	0.6	24	0.3	46.6
RDD13-1	bT	5.8	0.055	0.06	0.6	25	0.2	42.2
RDD13-2	bT	6.4	0.041	0.09	0.7	34	0.2	64.2
RDD14	bT	6.2	0.059	0.06	0.6	28	0.3	38.8
RDD15	bT	7.4	0.028	0.07	1.1	34	< .1	52.9
RDE02	bT	4.5	0.018	0.08	0.7	32	0.2	44.3
RDE03	bT	5.3	0.045	0.07	0.7	28	0.2	38.5
RDE04	bT	4.1	0.043	0.08	0.7	27	0.1	54
RDE05	bT	8.3	0.072	0.08	0.6	33	0.1	59.3
RDE07	bT	6.7	0.025	0.11	1.3	27	0.1	53.4
RDE08	bT	5.1	0.068	0.08	1.1	27	0.2	54.2
RDE09	bT	7.5	0.043	0.09	3.6	34	0.2	46.1

APPENDIX 4a: Geochemical results from ICP-MS (Th – Zn) Continued

Sample ID	Till Type	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
RDE10	BT	6.5	0.067	0.07	0.8	32	0.2	42.4
RDE11	bT	7.7	0.089	0.07	0.9	37	0.2	55.4
RDE12	aT	5.4	0.061	0.09	1	33	0.3	47.8
RDE13	bT	4.7	0.059	0.07	0.8	27	0.2	59.1
RDE14	bT	6.1	0.039	0.06	0.9	26	0.2	53.5
RDE15	bT	7.2	0.037	0.08	0.6	28	0.2	65.4
RDEF06	bT	8.3	0.066	0.08	0.9	32	0.2	43.4
RDF02	aT	6.7	0.06	0.05	0.8	23	0.2	38.6
RDF03	bT	6.1	0.062	0.04	0.7	22	0.1	36
RDF04	bT	6.3	0.068	0.04	0.9	23	0.2	32.1
RDF05	bT	7.5	0.074	0.06	0.8	29	0.2	39.1
RDF07	bT	7.3	0.067	0.05	0.7	23	0.2	38.5
RDF08	bT	3.4	0.031	0.14	1	33	0.2	67.7
RDF09	bT	8.6	0.078	0.07	1	30	0.3	50
RDF10	bT	7.1	0.049	0.08	0.9	26	0.2	42.1
RDF11	aT	9.5	0.062	0.12	1	33	0.4	68.2
RDF12	bT	3	0.015	0.1	0.5	42	0.2	58.3
RDF13	aT	5.3	0.03	0.07	0.5	28	0.2	65.4
RDF14	bT	5.2	0.028	0.1	0.7	34	0.3	76.4
RDF15	bT	6.8	0.036	0.08	0.6	29	0.3	48.7
RDG02	bT	7.3	0.079	0.07	0.9	28	0.2	40.9
RDG03	bT	8	0.074	0.06	1	27	0.1	39.9
RDG04	bT	9	0.061	0.07	1.3	27	0.1	52.5
RDG05	bT?	9.4	0.037	0.07	1.4	31	< .1	59.1
RDG06	aT	7.1	0.057	0.08	0.9	29	0.2	40.4
RDG07	bT?	7.5	0.07	0.06	0.9	28	0.2	39.9
RDG08	bT	7.2	0.062	0.07	0.8	30	0.3	52.5
RDG09	bT	8.2	0.073	0.07	0.8	31	0.3	48.5
RDG10	aT	5.6	0.035	0.1	0.8	28	0.2	50.1
RDG11	aT?	5.7	0.018	0.08	0.6	24	0.2	68.5
RDG12	bT	8.6	0.081	0.12	0.8	41	0.3	67.3
RDG12FD	bT	9.2	0.096	0.1	0.9	40	0.2	63.5
RDG13	bT	8.4	0.078	0.08	0.7	32	0.3	52.1
RDG14a	aT	7.1	0.026	0.13	1.3	51	0.9	84.9
RDG14b	bT	7.8	0.1	0.09	0.7	39	0.3	48.4
RDG15	aT	8.2	0.036	0.1	1	32	0.9	58
RDH02	bT	7.3	0.05	0.05	1	20	0.1	29.2
RDH03	aT	7	0.067	0.04	0.9	20	0.2	27.9
RDH04	aT	4.3	0.065	0.12	1.6	55	0.4	66.8
RDH05	bT?	5.3	0.05	0.09	2.7	28	0.2	49.2
RDH06	bT	9.3	0.052	0.06	1	25	0.2	57.6
RDH07	bT	5.4	0.022	0.09	1	36	0.2	43.3
RDH08	bT	2.6	0.023	0.08	0.6	26	0.1	47.5
RDH09	bT	6.4	0.055	0.04	1.2	24	0.2	36.3

APPENDIX 4a: Geochemical results from ICP-MS (Th – Zn) Continued

Sample ID	Till Type	Th	Ti	Tl	U	V	W	Zn
		ppm	%	ppm	ppm	ppm	ppm	ppm
RDH10	?	7.3	0.029	0.04	1.7	21	0.1	43.3
RDH11	bT	7.2	0.065	0.1	1	28	0.4	34.4
RDH12	bT	6	0.055	0.07	0.7	23	0.2	37.6
RDH13	bT	8.2	0.062	0.08	0.8	30	0.3	54.6
RDH14.5	bT	6.4	0.045	0.08	0.9	29	0.5	56.4
RDK02	bT	7.6	0.046	0.06	0.8	21	0.2	38.6
RDK03	bT	7.6	0.063	0.06	0.8	22	0.2	26.6
RDK04	bT	7.7	0.052	0.05	0.9	26	0.1	44.1
RDK05	bT	6.1	0.052	0.06	0.7	20	0.2	27.6
RDK06	aT	6	0.039	0.03	1.5	18	0.1	31.5
RDK07	aT	4.3	0.028	0.04	1.2	21	< .1	46.6
RDK08	bT	6.9	0.052	0.12	0.8	36	0.2	54
RDK09	bT	3.7	0.022	0.05	0.9	25	0.1	32.2
RDK10	bT	4.9	0.045	0.07	0.6	26	0.1	41.4
RDK11	bT	7.9	0.083	0.09	1.3	36	0.2	47.5
RDK12	aT?	11	0.05	0.06	1.5	29	1.1	67.2
RDK13	bT	7.6	0.021	0.15	0.8	34	1.4	48.7
RDK14	bT?	3.8	0.024	0.13	0.7	30	0.9	58.5
RDK15	bT	4.5	0.059	0.09	1.1	33	0.4	51.2
RDL02	aT	7	0.029	0.12	1	33	0.2	57
RDL03	bT	8.3	0.054	0.08	0.9	24	0.2	34.3
RDL04	bT	7.2	0.046	0.05	0.8	24	0.2	35.9
RDL05	bT	4.3	0.027	0.09	4.9	28	0.1	62.3
RDL06	aT	5.1	0.056	0.06	0.8	28	0.2	36.2
RDL07	bT	4.8	0.028	0.05	1.5	24	0.2	31.5
RDL08	bT	5.2	0.038	0.12	0.9	37	0.2	61.6
RDL09	bT	7.5	0.084	0.08	0.7	32	0.2	45.6
RDL10	aT	5.5	0.066	0.09	0.8	34	0.2	45.2
RDL11a	aT	8.1	0.076	0.06	0.9	28	0.4	41.7
RDL11b	aT	7.8	0.067	0.09	2.1	35	0.3	50.4
RDL12	aT	7.8	0.067	0.08	1	28	0.6	50.2
RDL13	aT	20	0.015	0.17	2	25	0.4	51.5
RDL14	bT	9	0.087	0.18	1.4	36	0.5	49.1
RDL15	bT	11	0.092	0.19	2	46	0.3	78.7
RDM02	aT	7.2	0.032	0.06	0.7	20	0.2	37.6
RDM03	bT	5.4	0.019	0.09	1.3	29	0.1	41.4
RDM03FD	bT	5.8	0.029	0.07	1.2	23	0.2	37.7
RDM04	bT	7	0.055	0.05	0.8	24	0.2	38.6
RDM05	bT	6	0.01	0.08	0.6	21	0.1	56
RDM06	bT	6.2	0.07	0.06	1.1	31	0.3	39
RDM07	bT	6.3	0.043	0.04	0.8	20	0.1	35.8
RDM08	bT	5.7	0.056	0.07	0.8	27	0.2	38.9
RDM09	bT	7.1	0.033	0.07	0.9	25	0.2	46.4
RDM10	bT	8.4	0.067	0.07	0.9	31	0.3	38.2

APPENDIX 4a: Geochemical results from ICP-MS (Th – Zn) Continued

Sample ID	Till	Th	Ti	Tl	U	V	W	Zn
	Type	ppm	%	ppm	ppm	ppm	ppm	ppm
RDM11	aT	9.4	0.034	0.1	1.2	33	0.3	50.3
RDM12	bT	6.8	0.065	0.17	1.4	37	19.8	78.2
RDM13	bT	9.5	0.088	0.12	1	39	0.4	63
RDM14	bT?	7.8	0.067	0.1	1.3	31	1.1	61
RDM15-1	aT	10.1	0.094	0.14	1.5	40	1.1	53.7
RDM15-2	bT	9.6	0.081	0.16	1.1	39	0.7	65.4
RDN02	bT	7.7	0.047	0.05	1.6	18	0.2	30.6
RDN03	aT	7	0.045	0.04	0.8	17	0.2	29.7
RDN04	bT	6.8	0.037	0.05	0.8	20	0.2	27.5
RDN05	bT	5	0.039	0.06	0.7	21	0.1	41.2
RDN06	bT	5.6	0.042	0.05	0.7	22	0.1	36.2
RDN07	aT	7.4	0.064	0.05	0.7	24	0.2	37
RDN08	aT	7.6	0.057	0.04	0.9	21	0.2	36
RDN09	bT	7.7	0.07	0.07	0.8	28	0.2	43.2
RDN10	bT	9.6	0.049	0.07	1.5	26	1	57.3
RDN11	bT?	7.3	0.077	0.08	1.2	35	10.5	65.1
RDN12	bT	12.5	0.072	0.24	2.1	51	1	40.7
RDN13	aT?	15.3	0.032	0.15	2.2	26	1.1	56.1
RDN14	bT	5.3	0.061	0.09	1	29	1.4	42.2
RDN15	bT	8.2	0.062	0.12	2	29	19.4	52.7
RDP02	bT	7.8	0.062	0.06	0.9	24	0.3	32.6
RDP03	bT	8.5	0.091	0.09	0.9	32	0.2	42.1
RDP04	bT	5.9	0.041	0.07	0.7	23	0.2	35.9
RDP05	aT	8	0.058	0.03	0.6	27	< .1	47.7
RDP06	bT	4.3	0.029	0.07	0.6	24	< .1	49.7
RDP07	bT	7.2	0.063	0.06	0.7	28	0.1	47.3
RDP08	bT	8.7	0.098	0.09	0.9	31	0.2	45.7
RDP09	aT	5.5	0.071	0.04	0.7	25	0.2	35.6
RDP10	bT	5.7	0.034	0.08	0.8	30	0.2	64.9
RDP11	bT	8.5	0.104	0.08	1.5	39	0.5	55.4
RDP12	bT	9.5	0.114	0.12	1	49	0.3	71.5
RDP13	bT	9.5	0.072	0.12	1.2	35	0.5	36.5
RDP14	aT	7.9	0.069	0.08	1.1	31	1.7	44.1
RDP15	bT	4.8	0.039	0.12	0.8	35	1	36
RDQ02	bT	9	0.086	0.11	1	33	0.3	45.4
RDQ03	bT	10.2	0.101	0.1	0.9	34	0.3	43.1
RDQ04	bT	8.9	0.059	0.06	0.8	34	< .1	55.6
RDQ05	bT	6.3	0.041	0.08	0.8	27	0.2	32.5
RDQ06	bT	11.3	0.086	0.05	1.2	32	0.2	56.4
RDQ07	aT	7.9	0.026	0.07	0.8	29	0.4	45.7
RDQ09	bT	9.8	0.058	0.07	1.1	25	0.6	53.6
RDQ10	bT	13.7	0.023	0.13	1.8	38	1.8	88.5
RDQ11	bT	7.7	0.085	0.08	2	32	0.4	51
RDQ12	bT	7.4	0.085	0.07	0.7	33	0.2	44.9

APPENDIX 4a: Geochemical results from ICP-MS (Th – Zn) Continued

Sample ID	Till	Th	Ti	Tl	U	V	W	Zn
	Type	ppm	%	ppm	ppm	ppm	ppm	ppm
RDQ13	bT?	7.6	0.06	0.11	1.1	35	1.1	55.8
RDQ14	bT	5.6	0.055	0.1	0.9	32	0.4	40.1
RDQ15	bT	4.3	0.052	0.1	0.8	39	0.4	60.9
RDR02	bT	6.9	0.077	0.08	1	28	0.4	38.8
RDR03	bT	8.9	0.067	0.07	0.9	27	0.3	43.6
RDR04	bT	10.3	0.073	0.06	0.9	29	0.2	44.5
RDR05	bT?	7.3	0.037	0.06	0.6	26	0.1	53.9
RDR06	bT?	8.3	0.03	0.05	0.9	23	0.2	67.3
RDR07	bT	12.8	0.088	0.09	1.4	43	0.3	74.9
RDR08	bT	8.7	0.07	0.06	1.1	29	0.2	51.1
RDR09	bT?	15.4	0.034	0.06	1.8	30	0.2	109.5
RDR10	bT	9.7	0.108	0.1	0.9	39	0.4	56.1
RDR11	bT	10.3	0.07	0.07	2.1	31	0.2	47.9
RDR12	bT	6.3	0.05	0.09	1	36	0.3	65.9
RDR12FD	bT	9.5	0.097	0.08	1.2	43	0.2	61.2
RDR13	bT	2.4	0.029	0.08	1	31	0.2	55.4
RDR14	aTv	7.1	0.01	0.16	1.2	42	0.3	76.2
RDR15	bT	8.8	0.066	0.1	0.9	43	0.2	70.4
RDS02	bT	7.2	0.058	0.1	0.8	36	0.5	21.5
RDS03	bT	11.6	0.103	0.07	1	25	1.4	29.2
RDS04	bT	10.4	0.092	0.09	1	28	0.5	35.8
RDS05	aT?	6.7	0.015	0.14	1.5	30	0.7	60.4
RDS06	bT	10.2	0.021	0.07	1.2	28	0.1	109.5
RDS07	bT	9.7	0.028	0.08	1.1	28	0.1	80.1
RDS07.5	bT	11.1	0.083	0.06	1.6	33	0.2	66.8
RDS08	bT	12	0.075	0.06	1.2	36	0.2	72.8
RDS09	bT	10	0.06	0.05	1.3	36	0.3	71.4
RDS10	bT	4.7	0.022	0.1	1.5	31	0.2	63.7
RDS11	bT	6.1	0.059	0.11	0.8	39	0.3	50.8
RDS12	bT	8.1	0.071	0.1	1	35	0.3	49.8
RDS12FD	bT	9.3	0.098	0.11	1.1	40	0.3	52
RDS13	bT	8	0.082	0.07	0.9	37	0.2	49.4
RDS14	bT?	7.4	0.056	0.08	1.1	30	0.1	59.5
RDS15	bT	9.8	0.117	0.14	1	49	0.3	62
RDT02	bT	7.7	0.07	0.11	1.3	29	8.7	53.6
RDT03	bT	8.6	0.069	0.12	1.3	31	1.3	49.8
RDT04	aT	11.4	0.046	0.12	1.4	33	2	66.6
RDT05	bT	11.3	0.033	0.1	1.6	30	1	73.9
RDT06	bT	10.2	0.044	0.05	1.3	27	0.1	65.2
RDT07	aT	13.4	0.049	0.04	1.2	23	0.2	88.2
RDT08	aT	14.8	0.04	0.06	2.3	37	0.2	113.3
RDT09	bT	12	0.067	0.06	1.5	30	0.5	66.2
RDT9.5	bT	12.6	0.05	0.07	1.5	30	0.3	79.7
RDT10	bT	7.1	0.056	0.09	1.2	29	0.4	66.4

APPENDIX 4a: Geochemical results from ICP-MS (Th – Zn) Continued

Sample ID	Till	Th	Ti	Tl	U	V	W	Zn
	Type	ppm	%	ppm	ppm	ppm	ppm	ppm
RDT11	bT	10.9	0.039	0.09	1.9	28	0.4	67.5
RDT12	bT	9.9	0.068	0.11	1.3	36	0.4	75.4
RDT13	bT	7	0.063	0.08	0.9	30	0.3	50.5
RDT14	bT	7	0.082	0.08	0.8	34	0.2	50.3
RDT15	bT	9.6	0.082	0.1	1.3	39	0.3	51.1
RDV02a	bT	11.7	0.087	0.14	1.4	29	16.1	41.2
RDV02b	bT	9.4	0.088	0.12	1.2	27	14.7	35.3
RDV03	bT	13.2	0.169	0.23	1.2	51	1	61.3
RDV03FD	bT	12.1	0.154	0.22	1.3	50	1	62.6
RDV04	bT	11.9	0.13	0.14	1.2	38	2.3	46.2
RDV05	bT	10.9	0.097	0.1	1.2	29	0.5	39.1
RDV06	bT	13	0.091	0.11	1.5	37	0.9	55.6
RDV07a	aT?	10.5	0.082	0.08	1.2	31	0.4	47.3
RDV07b	bT	12.1	0.077	0.07	1.1	34	0.2	94.9
RDV08	bT	10.8	0.075	0.09	1.2	36	0.2	88.1
RDV09	bT	12.4	0.061	0.08	1.7	30	0.3	135.6
RDV10	aT	8.4	0.022	0.14	1.5	35	4.9	65.4
RDV11	aT?	3.7	0.034	0.11	1.1	32	0.3	66.4
RDV12	bT	5.6	0.066	0.08	1	25	0.4	62.4
RDV13	bT	7.9	0.108	0.16	0.8	35	0.8	48.5
RDV14	bT	7	0.048	0.14	0.9	43	0.4	56.5
RDV15	bT	8	0.066	0.1	1.6	28	0.3	38.9
RDW02	bT	9.5	0.108	0.09	1	37	0.4	45
RDW03	bT	8	0.049	0.05	1	26	0.9	56
RDW04	bT	7.7	0.036	0.05	1.2	22	0.7	59.4
RDW05	bT	8.3	0.039	0.1	1.1	26	1.3	56.4
RDW06	bT	12.6	0.123	0.14	1.1	45	0.6	63.8
RDW07	aT	14.2	0.039	0.07	1.3	27	1.2	87.9
RDW08	bT?	13.1	0.086	0.11	1.3	38	0.3	70.3
RDW09	bT	9.1	0.034	0.18	1.3	35	0.6	73
RDW10	bT	5.9	0.016	0.17	3.1	30	0.6	60.7
RDW11	bT	11.3	0.076	0.11	2	39	0.5	77.5
RDW12	bT	7.9	0.069	0.14	1.2	37	0.4	54
RDW13	bT	6.6	0.05	0.1	0.9	34	0.3	61.2
RDW14	bT	4.8	0.047	0.11	1	38	0.5	45
RDW15	bT	8.7	0.082	0.07	0.9	37	0.3	42.9
RDX02	bT	7.1	0.055	0.09	1.1	26	1.3	34.6
RDX03	bT	10.8	0.099	0.09	0.9	33	0.7	45.2
RDX04	bT?	8.9	0.064	0.13	1.1	36	2.3	57.4
RDX05	bT?	10.6	0.107	0.13	1	37	0.5	47.3
RDX06	bT	12.4	0.098	0.11	1.4	34	1.1	84.3
RDX07	bT	6.4	0.076	0.13	1.1	34	0.5	71
RDX08	bT	11.2	0.095	0.13	16	40	0.4	72.5
RDX09	aT	7.2	0.019	0.1	1.4	28	0.3	208.3

APPENDIX 4a: Geochemical results from ICP-MS (Th – Zn) Continued

Sample ID	**Till Type**	**Th**	**Ti**	**Tl**	**U**	**V**	**W**	**Zn**
		ppm	%	ppm	ppm	ppm	ppm	ppm
RDX10a	aT	9.3	0.056	0.06	1.4	27	0.6	81.3
RDX10b	aT	11.6	0.078	0.08	1.9	36	0.4	95.8
RDX11	bT	12.5	0.081	0.15	3.2	46	1.5	114.2
RDX12-1	aT?	5.5	0.058	0.14	1.4	56	0.5	40.5
RDX12-2	aT?	7.2	0.059	0.13	1.2	42	0.6	83.8
RDX13	bT	7	0.081	0.16	0.8	40	1	76.9
RDX14	bT	7.3	0.093	0.13	0.9	40	0.3	63.6
RDX15	bT	6.7	0.087	0.07	1.1	38	0.5	40.2

Part B: Geochemical Results from INAA Analysis

Instrumental Neutron Activation Analysis (INAA) was conducted on the clay plus silt (<0.063mm) fraction of the 272 collected till samples. Analysis was performed by Becquerel Laboratories®, Mississauga, Ontario. Elements analyzed for included: Ag, As, Au, Ba, Br, Cd, Ce, Co, Cr, Cs, Eu, Fe, Hf, Ir, La, Lu, Mo, Na, Ni, Rb, Sb, Sc, Se, Sm, Sn, Ta, Tb, Te, Th, U, W, Yb, Zn, and Zr. Data for Ag, Cd, Ir, Mo, Ni, Se, Sn, Te, Zn, Zr are not presented in this report due to inadequate detection limits or precision. Table IV-3 shows elements presented with their corresponding detection limits.

Element	Detection Limit	Element	Detection Limit	Element	Detection Limit
As	0.5 ppm	Eu	1 ppm	Sc	0.2 ppm
Au	2 ppb	Fe	0.2 %	Sm	0.1 ppm
Ba	50 ppm	Hf	1 ppm	Ta	0.5 ppm
Br	0.5 ppm	La	2 ppm	Tb	0.5 ppm
Ce	5 ppm	Lu	0.2 ppm	Th	0.2 ppm
Co	5 ppm	Na	0.02 %	U	0.2 ppm
Cr	20 ppm	Rb	5 ppm	W	1 ppm
Cs	0.5 ppm	Sb	0.1 ppm	Yb	2 ppm

Table IV-2 – Elements analyzed and corresponding detection limit as defined by Bequerel Laboratories®. Method of analysis is INAA.

APPENDIX 4b: Geochemical results from INAA analysis of till samples (As - Fe)

Sample	Till	As	Au	Ba	Br	Ce	Co	Cr	Cs	Eu	Fe
ID	Type	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%
RDA02	bT	8.7	-2	400	5.2	110	13	65	2.7	-1	2.70
RDA03-1	aT	10.0	-2	390	27.0	99	11	81	3.2	1	2.80
RDA03-2	aT	14.0	-2	410	16.0	110	15	82	3.3	1	3.20
RDA04	bT	12.0	-2	420	1.0	130	13	95	3.2	2	3.10
RDB02	bT	10.0	-2	390	9.5	120	13	99	3.0	1	3.20
RDB03	bT	14.0	-2	380	5.2	110	13	86	3.4	-1	2.80
RDB04	bT	13.0	-2	350	14.0	100	12	80	2.5	1	2.50
RDB05	bT	13.0	-2	340	7.9	110	12	78	2.5	-1	2.60
RDB06	bT	10.0	-2	390	4.0	100	16	94	3.1	1	3.00
RDB13	bT	11.0	-2	350	10.0	98	12	65	3.4	1	2.80
RDB14	bT	15.0	-2	370	11.0	99	13	99	2.8	-1	3.60
RDB15	bT	12.0	-2	490	5.0	110	12	74	3.8	2	3.20
RDC02	aT	17.0	-2	340	34.0	99	15	100	3.6	1	3.20
RDC03	bT	13.0	3	430	1.7	97	15	87	3.8	2	3.30
RDC04	bT	8.6	-2	320	20.0	100	12	94	3.4	1	3.00
RDC05	bT	13.0	-2	370	26.0	99	14	77	3.6	-1	3.50
RDC06	bT	13.0	-2	360	26.0	95	10	88	4.1	1	3.30
RDC07	aT	19.0	-2	310	14.0	120	11	81	2.8	2	3.00
RDC12	bT	10.0	-2	380	18.0	93	12	84	3.3	-1	3.20
RDC13	bT	12.0	-2	380	6.9	100	13	97	3.1	1	3.20
RDC14	bT	10.0	-2	370	5.2	100	11	81	3.1	-1	3.00
RDC15	bT	14.0	-2	360	13.0	100	12	77	2.6	1	3.10
RDCD11	bT	16.0	-2	450	5.6	110	14	88	4.1	1	3.70
RDD02	aT	12.0	-2	390	35.0	110	8	73	3.5	1	2.70
RDD03	bT	9.1	-2	420	1.4	110	12	95	3.2	2	3.10
RDD04	bT	6.7	-2	380	4.3	110	13	83	2.7	-1	2.50
RDD05	aT	16.0	-2	360	12.0	130	15	95	3.0	2	3.40
RDD06	bT	11.0	-2	440	5.9	110	16	82	5.0	1	3.50
RDD07	bT	15.0	-2	460	1.4	110	14	86	4.5	1	3.40
RDD08	aT	16.0	-2	360	13.0	110	15	96	3.3	-1	3.00
RDD09	bT	15.0	-2	400	2.9	100	13	73	3.1	2	3.00
RDD10	bT	18.0	-2	440	2.2	130	14	82	3.4	2	3.90
RDD12	bT	18.0	-2	390	13.0	120	16	87	2.8	-1	3.50
RDD13-1	bT	11.0	-2	400	16.0	98	12	87	2.9	-1	3.00
RDD13-2	bT	16.0	-2	460	7.5	100	16	95	3.9	1	3.70
RDD14	bT	17.0	-2	310	12.0	110	15	79	2.3	-1	3.10
RDD15	bT	14.0	-2	480	1.6	91	17	110	4.8	1	3.60
RDE02	bT	10.0	-2	320	33.0	99	8	93	3.6	-1	3.40
RDE03	bT	12.0	-2	360	17.0	110	11	96	3.7	2	3.10
RDE04	bT	9.1	-2	370	17.0	96	11	110	3.7	1	3.30
RDE05	bT	16.0	-2	410	2.6	110	20	100	3.8	2	4.00
RDE07	bT	7.1	-2	430	7.1	110	15	100	3.9	1	3.40
RDE08	bT	8.5	-2	410	9.1	98	13	100	3.2	-1	3.10
RDE09	bT	16.0	-2	420	8.3	120	13	93	4.5	1	3.90
RDE10	bT	10.0	-2	350	3.9	100	17	83	3.0	1	3.20

APPENDIX 4b: Geochemical results from INAA analysis of till samples (As - Fe) Continued

Sample	Till	As	Au	Ba	Br	Ce	Co	Cr	Cs	Eu	Fe
ID	Type	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%
RDE11	bT	13.0	-2	440	3.9	110	16	83	3.4	-1	3.80
RDE12	aT	23.0	-2	320	22.0	130	21	100	3.5	1	3.70
RDE13	bT	13.0	-2	420	15.0	93	12	94	3.5	2	3.50
RDE14	bT	13.0	-2	440	16.0	100	13	100	3.4	1	3.40
RDE15	bT	15.0	-2	450	5.3	100	12	97	3.6	-1	3.50
RDEF06	bT	12.0	-2	420	4.0	130	15	89	3.2	2	3.60
RDF02	aT	12.0	-2	330	8.0	120	16	85	2.7	-1	3.00
RDF03	bT	12.0	-2	330	10.0	110	12	76	2.7	2	2.90
RDF04	bT	13.0	-2	330	20.0	120	10	82	2.3	2	2.70
RDF05	bT	14.0	-2	400	7.2	130	16	92	3.2	2	3.40
RDF07	bT	16.0	-2	400	4.2	120	14	76	2.5	1	3.00
RDF08	bT	10.0	-2	370	21.0	89	13	88	4.5	1	3.40
RDF09	bT	19.0	15	400	12.0	120	17	91	3.2	1	3.90
RDF10	bT	14.0	-2	370	23.0	120	13	96	3.2	1	3.30
RDF11	aT	22.0	-2	400	16.0	120	17	120	4.4	-1	3.90
RDF12	bT	15.0	-2	280	18.0	76	7	84	4.9	1	4.20
RDF13	aT	30.0	-2	380	13.0	85	17	97	4.2	1	3.50
RDF14	bT	17.0	-2	430	35.0	95	12	97	4.0	1	4.00
RDF15	bT	13.0	6	370	3.6	87	11	86	3.3	1	3.2
RDG02	bT	10.0	-2	420	6.6	110	13	75	3.5	1	3.0
RDG03	bT	9.3	-2	420	2.9	120	11	76	3.0	1	2.8
RDG04	bT	14.0	-2	390	1.4	120	15	82	3.6	1	3.1
RDG05	bT?	25.0	-2	420	-0.5	100	24	100	3.5	2	4.4
RDG06	aT	17.0	-2	340	16.0	120	13	94	3.0	-1	3.3
RDG07	bT?	18.0	2	360	12.0	120	14	72	2.4	1	3.1
RDG08	bT	19.0	-2	350	22.0	130	13	95	3.2	1	3.3
RDG09	bT	12.0	-2	410	4.1	110	13	73	3.4	-1	3.4
RDG10	aT	8.8	-2	360	19.0	97	12	85	3.9	-1	3.0
RDG11	aT?	25.0	-2	340	18.0	96	14	100	3.8	-1	3.6
RDG12	bT	19.0	-2	510	-0.5	87	15	90	4.8	2	4.5
RDG12FD	bT	15.0	-2	480	5.2	100	15	74	4.0	-1	3.9
RDG13	bT	15.0	-2	460	0.6	110	16	80	3.7	2	3.6
RDG14a	aT	38.0	-2	300	48.0	86	10	83	8.3	-1	4.9
RDG14b	bT	19.0	-2	400	3.3	120	16	97	3.2	1	3.6
RDG15	aT	29.0	-2	420	10.0	130	19	92	4.5	2	3.9
RDH02	bT	12.0	3	390	5.1	110	12	68	2.5	1	2.3
RDH03	aT	12.0	10	330	25.0	100	10	72	2.2	-1	2.5
RDH04	aT	37.0	-2	200	111.0	69	13	95	3.8	1	5.3
RDH05	bT?	14.0	-2	400	20.0	130	12	100	4.5	1	3.5
RDH06	bT	34.0	-2	410	2.1	120	21	110	3.6	2	4.0
RDH07	bT	15.0	-2	310	16.0	91	12	87	3.8	-1	4.0
RDH08	bT	9.2	-2	330	33.0	78	7	70	3.1	-1	2.7
RDH09	bT	13.0	-2	350	4.7	110	14	83	2.9	1	2.9
RDH10	?	19.0	-2	420	3.9	110	16	100	3.7	1	3.5
RDH11	bT	16.0	-2	340	20.0	120	12	79	3.0	-1	2.8

APPENDIX 4b: Geochemical results from INAA analysis of till samples (As - Fe) Continued

Sample ID	Till Type	As ppm	Au ppb	Ba ppm	Br ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Eu ppm	Fe %
RDH12	bT	10.0	-2	350	17.0	92	11	84	3.0	1	2.7
RDH13	bT	18.0	3	450	2.6	99	15	81	4.1	-1	3.5
RDH14.5	bT	21.0	-2	420	7.6	100	14	77	4.0	-1	3.2
RDK02	bT	14.0	-2	390	8.5	120	15	79	2.8	1	2.9
RDK03	bT	11.0	-2	320	8.1	120	9	62	2.4	-1	2.2
RDK04	bT	31.0	5	430	3.4	120	19	94	4.0	2	4.1
RDK05	bT	9.4	-2	320	24.0	110	8	77	2.4	1	2.3
RDK06	aT	22.0	-2	310	8.0	110	15	75	2.7	2	2.7
RDK07	aT	10.0	-2	410	6.2	110	11	96	3.5	2	3.1
RDK08	bT	15.0	-2	410	13.0	100	17	91	4.0	-1	3.8
RDK09	bT	13.0	-2	360	10.0	110	10	92	3.9	1	3.0
RDK10	bT	7.7	-2	360	14.0	98	11	92	3.2	-1	2.7
RDK11	bT	14.0	-2	420	1.5	100	13	87	3.5	1	3.5
RDK12	aT?	100.0	-2	490	1.4	140	22	82	6.2	1	3.8
RDK13	bT	32.0	-2	350	32.0	90	12	85	11.0	1	4.9
RDK14	bT?	10.0	-2	400	23.0	85	10	87	5.5	1	3.1
RDK15	bT	15.0	-2	400	13.0	92	10	91	4.4	1	3.5
RDL02	aT	25.0	-2	330	30.0	110	14	96	3.7	1	4.4
RDL03	bT	18.0	-2	380	21.0	120	14	80	3.2	1	2.9
RDL04	bT	20.0	-2	360	15.0	120	14	85	3.1	1	3.1
RDL05	bT	17.0	-2	400	9.5	110	12	96	4.2	-1	3.4
RDL06	aT	18.0	-2	310	28.0	110	13	91	2.4	1	3.0
RDL07	bT	8.9	-2	390	8.5	120	9	110	3.8	2	2.6
RDL08	bT	12.0	-2	380	34.0	91	12	88	4.0	1	4.0
RDL09	bT	14.0	-2	420	5.4	110	16	92	3.4	-1	3.4
RDL10	aT	15.0	-2	340	13.0	110	15	100	2.9	1	3.3
RDL11a	aT	95.7	-2	320	16.0	120	16	84	2.7	1	3.2
RDL11b	aT	138.0	-2	410	14.0	110	15	95	4.2	1	4.1
RDL12	aT	33.0	-2	340	13.0	120	12	82	3.0	1	3.1
RDL13	aT	17.0 1	-2	600	3.0	110	11	130	23.0	1	7.0
RDL14	bT	36.0	-2	550	-0.5	110	20	85	9.5	1	3.8
RDL15	bT	22.0	-2	560	-0.5	100	22	100	6.7	1	4.6
RDM02	aT	21.0	-2	340	12.0	130	17	86	2.8	1	3.2
RDM03	bT	17.0	-2	380	4.6	99	18	110	3.6	1	3.2
RDM03FD	bT	18.0	-2	400	3.2	98	16	82	3.4	1	3.2
RDM04	bT	26.0	-2	290	13.0	110	17	82	2.4	1	3.3
RDM05	bT	13.0	-2	300	19.0	99	11	81	3.2	-1	3.1
RDM06	bT	22.0	-2	300	37.0	120	10	72	2.7	1	3.3
RDM07	bT	14.0	-2	390	6.0	120	12	74	3.2	1	2.7
RDM08	bT	14.0	-2	350	32.0	93	7	91	3.1	-1	2.7
RDM09	bT	13.0	-2	370	18.0	110	12	76	3.9	-1	2.9
RDM10	bT	21.0	-2	370	4.3	110	17	81	3.0	-1	2.8
RDM11	aT	34.0	-2	360	19.0	170	13	83	5.1	2	3.2
RDM12	bT	149.0	-2	340	25.0	100	18	95	21.0	2	4.0
RDM13	bT	16.0	-2	470	4.5	100	16	94	4.8	-1	3.6

APPENDIX 4b: Geochemical results from INAA analysis of till samples (As - Fe) Continued											
Sample	**Till**	**As**	**Au**	**Ba**	**Br**	**Ce**	**Co**	**Cr**	**Cs**	**Eu**	**Fe**
ID	**Type**	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%
RDM14	bT?	21.0	-2	600	4.9	96	15	69	5.8	-1	3.6
RDM15-1	aT	50.5	-2	560	7.7	120	28	92	6.5	2	4.1
RDM15-2	bT	37.0	-2	530	-0.5	100	18	95	6.5	1	4.6
RDN02	bT	14.0	4	400	4.0	120	10	58	3.3	-1	2.4
RDN03	aT	14.0	-2	370	5.1	120	10	67	2.5	-1	2.2
RDN04	bT	24.0	-2	290	24.0	160	15	74	2.4	1	2.8
RDN05	bT	20.0	-2	310	30.0	120	13	78	2.8	1	3.2
RDN06	bT	10.0	-2	360	15.0	110	9	77	2.9	1	2.6
RDN07	aT	23.0	-2	340	6.9	120	15	79	2.7	1	2.6
RDN08	aT	30.0	-2	370	6.1	120	12	67	3.0	2	2.4
RDN09	bT	13.0	-2	380	17.0	100	13	73	3.3	-1	2.8
RDN10	bT	54.4	3	460	17.0	130	16	73	4.9	1	3.5
RDN11	bT?	97.0	-2	340	35.0	120	18	110	4.4	2	3.9
RDN12	bT	92.5	-2	720	1.8	130	20	82	11.0	1	4.7
RDN13	aT?	15.0	-2	410	10.0	110	6	68	12.0	-1	3.4
RDN14	bT	31.0	-2	340	40.0	100	8	69	4.4	-1	3.0
RDN15	bT	34.0	-2	400	30.0	100	10	72	12.0	2	3.2
RDP02	bT	15.0	-2	370	16.0	130	12	68	2.7	2	2.6
RDP03	bT	15.0	-2	420	7.6	120	13	83	4.2	-1	3.2
RDP04	bT	17.0	-2	330	23.0	110	10	77	3.0	2	2.7
RDP05	aT	31.0	-2	410	0.7	130	23	86	3.5	2	3.6
RDP06	bT	13.0	-2	330	50.2	98	9	97	3.5	2	3.3
RDP07	bT	21.0	-2	410	19.0	120	9	75	3.8	1	3.1
RDP08	bT	16.0	-2	380	8.0	130	14	79	4.0	1	3.0
RDP09	aT	27.0	-2	310	10.0	97	15	62	2.0	1	2.6
RDP10	bT	20.0	-2	420	29.0	95	13	95	4.3	-1	3.4
RDP11	bT	35.0	-2	410	1.7	120	16	83	4.2	2	3.5
RDP12	bT	45.0	-2	530	2.0	100	19	90	6.3	2	4.0
RDP13	bT	38.0	-2	470	34.0	120	13	83	5.1	1	3.4
RDP14	aT	36.0	4	360	16.0	110	14	74	4.7	-1	3.1
RDP15	bT	23.0	-2	330	27.0	99	8	72	4.3	-1	2.8
RDQ02	bT	10.0	-2	440	14.0	130	12	73	4.3	-1	2.9
RDQ03	bT	13.0	-2	430	3.4	130	10	74	4.2	-1	2.8
RDQ04	bT	19.0	-2	430	10.0	110	15	130	4.5	1	4.0
RDQ05	bT	14.0	-2	330	8.4	110	14	70	3.0	-1	2.6
RDQ06	bT	30.0	-2	480	2.4	140	12	77	6.3	2	3.6
RDQ07	aT	50.0	-2	350	14.0	120	8	68	5.0	-1	3.6
RDQ09	bT	168.0	-2	410	29.0	140	17	77	3.5	2	3.5
RDQ10	bT	152.0	-2	500	31.0	130	21	87	10.0	1	5.3
RDQ11	bT	22.0	-2	460	18.0	120	21	83	4.1	1	3.3
RDQ12	bT	14.0	-2	430	1.9	110	13	88	3.4	1	3.2
RDQ13	bT?	40.0	-2	370	45.0	140	21	80	4.6	2	3.7
RDQ14	bT	28.0	-2	410	30.0	110	10	76	4.4	-1	3.3
RDQ15	bT	24.0	-2	360	32.0	91	12	97	4.1	1	3.6
RDR02	bT	8.6	-2	380	27.0	120	9	74	9.3	-1	2.6

APPENDIX 4b: Geochemical results from INAA analysis of till samples (As - Fe) Continued

Sample ID	Till Type	As ppm	Au ppb	Ba ppm	Br ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Eu ppm	Fe %
RDR03	bT	10.0	-2	410	23.0	140	11	84	4.0	-1	2.9
RDR04	bT	17.0	5	430	4.4	130	14	74	3.8	1	3.2
RDR05	bT?	22.0	-2	370	18.0	120	14	98	4.3	1	3.5
RDR06	bT?	124.0	-2	440	37.0	140	11	80	6.6	2	3.5
RDR07	bT	107.0	-2	520	2.4	130	17	96	7.0	1	4.1
RDR08	bT	30.0	-2	370	11.0	110	13	68	4.1	1	2.8
RDR09	bT?	28.0	-2	560	29.0	120	26	110	7.7	-1	4.4
RDR10	bT	34.0	-2	520	1.1	120	17	83	4.9	1	3.6
RDR11	bT	20.0	-2	470	1.8	130	15	85	4.8	2	3.2
RDR12	bT	23.0	-2	450	28.0	97	16	91	5.6	-1	3.9
RDR12FD	bT	24.0	-2	500	8.1	100	17	94	5.1	-1	3.9
RDR13	bT	12.0	6	390	12.0	80	8	96	3.9	1	2.9
RDR14	aTv	47.0	-2	440	36.0	89	10	110	7.9	1	6.5
RDR15	bT	16.0	-2	460	4.8	92	15	86	5.6	2	3.6
RDS02	bT	7.8	-2	290	8.2	94	7	69	15.0	2	2.2
RDS03	bT	13.0	-2	370	4.2	130	9	63	12.0	1	2.1
RDS04	bT	15.0	-2	400	13.0	130	13	68	4.7	2	2.6
RDS05	aT?	75.5	-2	270	58.1	100	9	70	7.7	-1	3.5
RDS06	bT	77.7	-2	490	17.0	120	18	85	9.4	1	3.9
RDS07	bT	58.0	-2	440	27.0	140	11	68	6.7	2	3.9
RDS07.5	bT	22.0	-2	470	2.0	150	20	70	4.5	2	3.2
RDS08	bT	27.0	-2	440	12.0	140	17	81	4.7	1	3.5
RDS09	bT	53.3	-2	530	12.0	110	16	85	6.0	-1	4.4
RDS10	bT	39.0	-2	480	31.0	160	19	81	9.3	2	4.0
RDS11	bT	20.0	-2	410	24.0	96	12	93	4.8	-1	3.6
RDS12	bT	19.0	-2	470	16.0	110	14	86	4.5	1	3.3
RDS12FD	bT	20.0	-2	440	10.0	97	16	85	4.8	1	3.4
RDS13	bT	15.0	-2	450	6.6	100	12	89	4.4	-1	3.3
RDS14	bT?	13.0	-2	440	19.0	120	12	80	4.9	1	3.3
RDS15	bT	22.0	-2	530	1.0	110	14	95	6.4	1	4.2
RDT02	bT	20.0	-2	470	4.4	130	13	82	16.0	1	2.9
RDT03	bT	56.4	-2	360	26.0	150	12	76	19.0	1	2.7
RDT04	aT	426.0	-2	350	22.0	140	14	71	11.0	1	3.7
RDT05	bT	56.8	-2	500	15.0	120	13	54	8.1	2	3.7
RDT06	bT	26.0	3	510	10.0	120	11	80	5.9	2	3.6
RDT07	aT	54.4	-2	470	7.4	170	28	69	6.4	2	3.8
RDT08	aT	69.3	-2	490	13.0	160	26	92	7.2	1	4.3
RDT09	bT	53.9	-2	440	2.9	150	14	77	4.6	1	3.3
RDT9.5	bT	69.2	-2	480	31.0	150	19	74	5.8	-1	3.9
RDT10	bT	57.6	-2	430	32.0	110	11	70	5.1	1	3.4
RDT11	bT	98.5	6	500	54.8	65	8	84	7.4	-1	9.0
RDT12	bT	33.0	-2	460	36.0	130	19	85	5.1	1	3.7
RDT13	bT	18.0	-2	410	16.0	110	10	73	3.5	1	3.0
RDT14	bT	11.0	-2	470	6.2	89	10	87	4.3	1	3.1
RDT15	bT	19.0	-2	470	11.0	98	15	88	4.5	-1	3.6

APPENDIX 4b: Geochemical results from INAA analysis of till samples (As - Fe) Continued

Sample ID	Till Type	As ppm	Au ppb	Ba ppm	Br ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Eu ppm	Fe %
RDV02a	bT	85.2	-2	430	2.1	180	22	100	19.0	-1	3.5
RDV02b	bT	27.0	-2	350	-0.5	130	9	86	18.0	1	2.6
RDV03	bT	19.0	-2	490	4.5	120	17	85	6.6	-1	3.9
RDV03FD	bT	24.0	-2	510	1.0	120	16	85	7.6	1	4.1
RDV04	bT	27.0	-2	460	7.6	140	15	74	12.0	-1	3.1
RDV05	bT	21.0	-2	430	10.0	130	14	67	5.3	1	2.8
RDV06	bT	56.3	-2	510	2.5	150	15	74	7.6	1	3.5
RDV07a	aT?	28.0	-2	410	24.0	140	12	79	4.3	2	3.4
RDV07b	bT	40.0	-2	490	9.0	140	15	87	6.2	1	3.8
RDV08	bT	20.0	-2	490	10.0	110	12	71	6.3	1	3.9
RDV09	bT	197.0	-2	430	13.0	140	24	80	8.1	1	4.0
RDV10	aT	89.4	-2	330	36.0	100	8	71	17.0	1	5.6
RDV11	aT?	24.0	-2	370	50.3	99	10	66	5.0	1	3.4
RDV12	bT	41.0	13	380	43.0	110	9	68	4.2	2	2.8
RDV13	bT	42.0	-2	430	1.9	110	16	65	5.0	2	3.2
RDV14	bT	24.0	-2	370	50.8	93	10	87	5.3	-1	4.2
RDV15	bT	19.0	-2	390	35.0	140	11	90	3.7	-1	3.2
RDW02	bT	10.0	-2	420	8.3	110	12	90	4.4	1	3.2
RDW03	bT	186.0	-2	420	8.2	140	15	120	9.0	2	3.8
RDW04	bT	214.0	-2	420	7.6	120	16	130	10.0	2	4.2
RDW05	bT	33.0	-2	420	30.0	130	11	78	10.0	-1	3.1
RDW06	bT	26.0	-2	520	3.2	130	17	83	8.4	1	3.9
RDW07	aT	69.5	-2	420	5.7	190	13	80	6.9	1	3.8
RDW08	bT?	71.9	4	460	1.6	140	17	86	6.3	1	3.9
RDW09	bT	34.0	-2	460	33.0	120	14	79	10.0	-1	3.9
RDW10	bT	27.0	-2	330	60.0	97	10	87	6.8	1	3.5
RDW11	bT	41.0	-2	520	1.2	130	18	74	7.2	1	4.2
RDW12	bT	51.4	-2	470	23.0	120	14	88	5.0	-1	3.5
RDW13	bT	27.0	-2	410	31.0	120	14	90	5.5	-1	3.7
RDW14	bT	20.0	-2	400	39.0	100	14	79	5.2	-1	3.6
RDW15	bT	13.0	-2	410	2.5	120	16	85	4.8	2	3.4
RDX02	bT	14.0	-2	360	17.0	110	8	69	6.9	1	2.6
RDX03	bT	57.6	-2	450	3.9	120	13	71	7.5	1	3.2
RDX04	bT?	175.0	-2	420	24.0	130	15	93	9.0	1	4.0
RDX05	bT?	20.0	-2	470	10.0	120	16	80	6.2	1	3.1
RDX06	bT	62.3	-2	510	4.4	160	24	86	9.5	2	3.5
RDX07	bT	22.0	-2	540	20.0	110	14	82	8.3	-1	3.9
RDX08	bT	38.0	-2	470	2.3	120	16	92	7.8	1	3.8
RDX09	aT	75.7	5	500	37.0	140	17	60	15.0	1	4.5
RDX10a	aT	91.0	9	340	15.0	150	28	67	4.2	1	3.6
RDX10b	aT	58.4	6	450	1.2	150	21	88	5.8	2	4.0
RDX11	bT	76.8	-2	480	2.2	110	20	96	8.4	1	4.4
RDX12-1	aT?	180.0	8	270	61.2	69	11	74	6.8	1	5.3
RDX12-2	aT?	120.0	8	400	43.0	90	11	71	9.2	1	4.3
RDX13	bT	245.0	4	400	21.0	100	13	67	5.5	-1	3.8

APPENDIX 4b: Geochemical results from INAA analysis of till samples (As - Fe) Continued

Sample ID	Till Type	As ppm	Au ppb	Ba ppm	Br ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Eu ppm	Fe %
RDX14	bT	58.1	-2	410	26.0	100	15	83	5.4	1	3.6
RDX15	bT	29.0	17	370	19.0	110	15	80	3.8	-1	3.4

APPENDIX 4b: Geochemical results from INAA analysis of till samples (Hf - Tb)

Sample ID	Till Type	Hf ppm	La ppm	Lu ppm	Na %	Rb ppm	Sb ppm	Sc ppm	Sm ppm	Ta ppm	Tb ppm
RDA02	bT	13	39	0.4	1.60	67	0.9	10.0	8.2	1.4	1.2
RDA03-1	aT	14	36	0.4	1.60	72	0.7	11.0	6.9	1.3	1.0
RDA03-2	aT	14	40	0.6	1.70	64	0.9	13.0	7.9	1.3	1.1
RDA04	bT	16	48	0.6	1.60	81	1.0	12.0	9.3	1.6	1.6
RDB02	bT	10	42	0.5	1.60	73	0.8	12.0	7.7	1.1	1.2
RDB03	bT	12	37	0.4	1.80	66	0.6	10.0	6.9	1.2	1.1
RDB04	bT	13	34	0.4	1.70	58	0.7	9.1	6.7	1.1	1.4
RDB05	bT	17	37	0.5	1.80	62	1.0	9.4	7.1	1.2	1.3
RDB06	bT	15	41	0.6	1.60	66	0.7	11.0	8.0	1.0	1.5
RDB13	bT	11	36	0.4	1.50	80	1.0	11.0	6.9	1.2	1.3
RDB14	bT	11	34	0.4	1.40	74	1.0	10.0	6.5	1.0	1.1
RDB15	bT	11	39	0.4	1.30	96	1.3	10.0	8.1	1.4	1.3
RDC02	aT	11	37	0.4	1.50	66	0.8	11.0	6.7	1.1	1.1
RDC03	bT	11	42	0.6	1.60	84	1.0	13.0	8.4	1.2	1.4
RDC04	bT	11	37	0.5	1.60	75	0.6	10.0	6.8	1.4	1.0
RDC05	bT	9	37	0.4	1.50	74	0.7	11.0	6.6	1.4	0.8
RDC06	bT	10	36	0.5	1.30	82	0.7	12.0	6.6	1.2	0.9
RDC07	aT	17	40	0.6	1.70	60	1.0	12.0	8.0	1.4	1.4
RDC12	bT	8	37	0.4	1.20	78	0.7	10.0	6.7	1.1	1.1
RDC13	bT	14	38	0.4	1.60	66	0.7	10.0	7.1	1.1	1.4
RDC14	bT	12	34	0.4	1.40	65	0.8	10.0	6.5	1.2	1.1
RDC15	bT	9	35	0.3	1.40	66	1.1	8.6	6.9	1.3	1.0
RDCD11	bT	10	41	0.4	1.40	94	1.5	13.0	7.7	1.2	1.1
RDD02	aT	13	39	0.5	1.70	60	0.7	10.0	7.2	1.2	0.9
RDD03	bT	14	43	0.6	1.60	77	0.7	12.0	8.1	1.1	1.2
RDD04	bT	14	40	0.5	1.80	64	0.7	10.0	7.2	1.3	0.9
RDD05	aT	14	41	0.6	1.60	61	0.9	12.0	8.2	0.9	1.2
RDD06	bT	11	43	0.4	1.50	110	1.0	13.0	8.3	1.7	1.3
RDD07	bT	11	41	0.4	1.60	83	1.3	13.0	8.0	1.2	1.2
RDD08	aT	17	39	0.6	1.50	69	0.8	11.0	7.2	1.2	1.1
RDD09	bT	12	37	0.4	1.50	63	1.4	10.0	7.7	1.2	1.1
RDD10	bT	13	45	0.5	1.80	77	1.4	13.0	10.0	1.3	1.3
RDD12	bT	12	43	0.6	1.70	63	1.1	11.0	7.5	1.4	1.1
RDD13-1	bT	14	37	0.5	1.70	61	0.9	11.0	7.0	1.1	1.0
RDD13-2	bT	9	39	0.4	1.3	84	1.4	13	7.3	1.0	1.1
RDD14	bT	14	40	0.6	1.70	64	1.3	11.0	7.5	1.4	1.2
RDD15	bT	7	38	0.4	1.30	94	1.0	14.0	7.1	1.1	0.8

APPENDIX 4b: Geochemical results from INAA analysis of till samples (Hf - Tb) Continued

Sample ID	Till Type	Hf ppm	La ppm	Lu ppm	Na %	Rb ppm	Sb ppm	Sc ppm	Sm ppm	Ta ppm	Tb ppm
RDE02	bT	14	40	0.5	1.40	66	0.8	9.3	6.8	1.1	0.9
RDE03	bT	15	42	0.6	1.70	73	0.8	12.0	8.0	1.4	1.4
RDE04	bT	12	37	0.4	1.50	81	0.6	11.0	6.5	1.2	0.8
RDE05	bT	9	38	0.5	1.40	76	1.2	14.0	7.3	1.2	1.0
RDE07	bT	9	38	0.4	1.40	81	0.5	11.0	7.7	1.1	1.3
RDE08	bT	12	36	0.4	1.50	82	0.8	10.0	7.5	1.4	1.1
RDE09	bT	13	50	0.6	1.50	85	0.8	14.0	10.1	1.4	1.4
RDE10	bT	13	39	0.5	1.80	63	0.9	11.0	7.4	1.2	1.0
RDE11	bT	11	40	0.5	1.50	73	1.0	13.0	7.3	1.4	1.3
RDE12	aT	13	39	0.5	1.40	55	1.0	11.0	7.2	1.0	1.4
RDE13	bT	11	37	0.5	1.50	67	0.8	11.0	6.6	1.1	1.2
RDE14	bT	13	40	0.6	1.50	84	1.1	12.0	7.2	1.4	1.0
RDE15	bT	10	41	0.6	1.40	94	1.2	13.0	7.4	1.3	1.1
RDEF06	bT	12	48	0.5	1.70	73	0.9	14.0	8.9	1.3	1.6
RDF02	aT	20	44	0.6	1.90	71	1.0	9.3	8.1	1.3	1.4
RDF03	bT	14	38	0.6	1.70	58	0.9	10.0	7.7	1.3	1.4
RDF04	bT	20	41	0.6	1.70	63	1.0	8.6	9.1	1.2	1.4
RDF05	bT	16	49	0.7	1.80	75	1.0	12.0	10.0	1.4	1.5
RDF07	bT	14	45	0.6	1.80	69	1.1	11.0	8.6	1.2	1.3
RDF08	bT	9	35	0.4	1.30	93	0.7	12.0	6.7	1.4	1.2
RDF09	bT	13	46	0.6	1.70	77	1.1	13.0	9.0	1.3	1.3
RDF10	bT	17	42	0.6	1.70	74	0.8	11.0	7.4	1.2	1.1
RDF11	aT	11	37	0.7	1.40	94	1.0	14.0	7.7	1.1	1.3
RDF12	bT	11	33	0.5	1.20	50	0.6	10.0	5.4	1.2	0.9
RDF13	aT	12	34	0.5	1.50	85	0.7	12.0	5.8	1.0	0.9
RDF14	bT	9	37	0.6	1.30	85	1.1	13.0	6.6	1.0	1.1
RDF15	bT	11	34	0.5	1.40	74	0.9	11.0	6.2	1.2	1.1
RDG02	bT	13	42	0.6	1.70	93	1.1	11.0	8.5	1.5	1.4
RDG03	bT	12	44	0.6	1.70	77	0.9	11.0	8.7	1.5	1.2
RDG04	bT	11	47	0.6	1.70	90	0.8	12.0	9.3	1.3	1.5
RDG05	bT?	12	44	0.7	1.50	85	0.7	14.0	8.8	1.4	1.5
RDG06	aT	13	38	0.6	1.60	66	0.9	10.0	7.3	1.2	1.0
RDG07	bT?	12	41	0.6	1.70	64	1.0	11.0	8.0	1.1	1.3
RDG08	bT	15	43	0.6	1.70	58	0.9	11.0	7.6	1.3	1.2
RDG09	bT	12	44	0.6	1.60	80	0.9	12.0	8.6	1.3	1.1
RDG10	aT	13	39	0.5	1.40	87	0.6	11.0	7.4	1.2	1.2
RDG11	aT?	11	35	0.4	1.40	70	0.7	11.0	6.5	1.1	1.1
RDG12	bT	7	38	0.5	1.20	110	1.5	13.0	7.8	1.2	1.3
RDG12FD	bT	9	39	0.4	1.20	94	1.3	12.0	7.9	1.4	1.1
RDG13	bT	10	47	0.6	1.60	94	1.2	13.0	9.3	1.6	1.4
RDG14a	aT	10	36	0.6	1.00	57	0.6	11.0	6.4	0.9	1.0
RDG14b	bT	13	44	0.6	1.50	71	1.2	14.0	8.9	1.3	1.1
RDG15	aT	10	41	0.5	1.40	91	1.2	13.0	7.5	1.1	1.1
RDH02	bT	14	43	0.6	1.90	67	1.0	10.0	8.8	1.2	1.2
RDH03	aT	17	40	0.7	1.80	58	0.9	9.0	8.2	1.1	1.2

APPENDIX 4b: Geochemical results from INAA analysis of till samples (Hf - Tb) Continued

Sample ID	Till Type	Hf ppm	La ppm	Lu ppm	Na %	Rb ppm	Sb ppm	Sc ppm	Sm ppm	Ta ppm	Tb ppm
RDH04	aT	7	26	0.4	0.73	46	0.6	10.0	5.1	0.5	1.0
RDH05	bT?	19	48	0.9	1.40	88	0.8	12.0	9.4	1.3	1.6
RDH06	bT	15	47	0.9	1.60	89	1.0	15.0	10.2	1.3	1.5
RDH07	bT	12	35	0.5	1.30	62	0.6	9.2	6.6	1.3	1.1
RDH08	bT	12	33	0.3	1.30	81	0.6	8.6	6.8	1.2	1.2
RDH09	bT	14	44	0.7	1.80	70	0.8	11.0	9.4	1.2	1.4
RDH10	?	12	46	0.7	1.60	81	0.7	13.0	9.3	1.2	1.4
RDH11	bT	15	40	0.7	1.70	64	0.8	11.0	7.8	1.3	1.2
RDH12	bT	12	38	0.5	1.60	73	0.7	11.0	7.5	1.4	1.2
RDH13	bT	10	40	0.5	1.30	90	1.1	13.0	7.7	1.2	1.0
RDH14.5	bT	9	39	0.5	1.40	86	0.9	11.0	7.4	1.2	1.0
RDK02	bT	13	42	0.6	1.70	79	1.0	9.4	8.6	1.4	1.3
RDK03	bT	16	39	0.6	1.70	67	0.8	7.9	7.9	1.1	1.3
RDK04	bT	14	49	0.8	1.60	88	1.3	13.0	11.0	1.3	1.6
RDK05	bT	15	41	0.6	1.90	63	0.8	8.7	7.6	1.4	1.2
RDK06	aT	16	47	0.9	1.90	62	0.9	11.0	11.0	1.2	2.0
RDK07	aT	13	45	0.6	1.60	90	0.5	11.0	8.2	1.2	1.4
RDK08	bT	11	40	0.6	1.60	84	0.9	13.0	7.1	1.3	1.0
RDK09	bT	12	44	0.6	1.60	87	0.6	11.0	7.9	1.4	1.0
RDK10	bT	14	39	0.6	1.70	78	0.6	10.0	7.0	1.2	1.1
RDK11	bT	12	43	0.6	1.60	87	1.0	13.0	8.3	1.5	1.3
RDK12	aT?	10	54	0.6	1.30	110	0.8	14.0	10.0	1.7	1.5
RDK13	bT	10	35	0.5	1.30	84	0.8	12.0	6.2	1.2	1.0
RDK14	bT?	12	36	0.5	1.30	100	0.5	11.0	6.4	1.2	1.3
RDK15	bT	12	37	0.5	1.40	87	0.6	12.0	7.0	1.4	1.0
RDL02	aT	14	41	0.7	1.50	63	0.8	11.0	7.6	1.2	1.4
RDL03	bT	14	44	0.7	1.80	85	0.8	11.0	8.5	1.3	1.5
RDL04	bT	15	45	0.8	1.80	73	0.9	11.0	8.6	1.2	1.3
RDL05	bT	12	42	0.7	1.50	88	0.7	13.0	8.4	1.4	1.4
RDL06	aT	19	39	0.6	1.80	54	0.8	9.4	7.1	1.2	1.1
RDL07	bT	22	52	0.8	1.90	77	0.6	11.0	9.1	1.5	1.5
RDL08	bT	11	37	0.6	1.30	91	0.7	12.0	7.0	1.2	1.2
RDL09	bT	11	41	0.6	1.60	81	0.9	12.0	7.8	1.3	1.1
RDL10	aT	15	37	0.5	1.80	67	0.9	12.0	6.8	1.2	1.1
RDL11a	aT	20	42	0.6	1.70	62	0.9	9.5	8.2	1.1	1.4
RDL11b	aT	16	47	0.7	1.50	78	1.2	12.0	11.0	1.2	1.8
RDL12	aT	20	49	0.8	1.60	66	1.0	10.0	9.4	1.4	1.5
RDL13	aT	8	53	0.7	0.50	200	0.5	20.7	8.8	1.9	1.4
RDL14	bT	12	48	0.7	1.60	110	1.0	15.0	10.0	1.4	1.4
RDL15	bT	9	44	0.6	1.40	130	1.4	16.0	8.5	1.5	1.4
RDM02	aT	16	48	0.7	1.70	73	1.0	10.0	8.7	1.2	1.5
RDM03	bT	11	42	0.6	1.70	82	0.7	12.0	8.0	1.2	1.2
RDM03FD	bT	13	42	0.7	1.80	81	0.7	11.0	8.3	1.2	1.5
RDM04	bT	15	45	0.7	1.70	60	1.1	10.0	8.7	1.2	1.4
RDM05	bT	11	40	0.6	1.40	77	0.5	9.4	7.6	1.0	1.2

APPENDIX 4b: Geochemical results from INAA analysis of till samples (Hf - Tb) Continued

Sample	Till	Hf	La	Lu	Na	Rb	Sb	Sc	Sm	Ta	Tb
ID	Type	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
RDM06	bT	20	39	0.6	1.50	60	0.9	9.2	8.7	0.9	1.6
RDM07	bT	15	42	0.6	1.70	90	0.7	10.0	8.7	1.2	1.7
RDM08	bT	13	34	0.5	1.50	74	0.7	9.5	6.6	1.2	1.2
RDM09	bT	13	38	0.6	1.50	70	0.6	10.0	6.8	1.4	1.1
RDM10	bT	10	39	0.5	1.50	70	0.8	12.0	7.7	1.2	1.1
RDM11	aT	12	33	0.4	1.30	85	0.5	12.0	6.4	1.3	1.1
RDM12	bT	10	33	0.4	1.40	66	0.8	13.0	6.3	0.5	1.2
RDM13	bT	8	38	0.4	1.10	100	1.1	13.0	6.9	1.3	1.1
RDM14	bT?	10	35	0.5	1.30	92	0.9	11.0	6.7	1.5	1.1
RDM15-1	aT	10	42	0.5	1.40	100	1.1	15.0	8.5	1.1	1.2
RDM15-2	bT	10	42	0.6	1.30	130	1.3	16.0	8.5	1.2	1.7
RDN02	bT	17	44	0.6	1.70	92	1.2	8.2	10.4	1.5	1.7
RDN03	aT	18	43	0.7	1.90	82	0.9	7.8	8.8	1.5	1.5
RDN04	bT	17	40	0.7	1.70	64	0.8	8.2	8.1	1.1	1.4
RDN05	bT	14	42	0.6	1.70	67	0.8	9.4	8.1	1.3	1.6
RDN06	bT	13	42	0.5	1.70	72	0.7	10.0	8.1	1.3	1.5
RDN07	aT	16	41	0.6	1.70	61	0.8	9.0	8.0	1.3	1.3
RDN08	aT	17	42	0.6	1.70	74	1.0	10.0	8.4	1.1	1.4
RDN09	bT	12	38	0.4	1.60	81	0.8	11.0	7.1	1.2	1.2
RDN10	bT	12	41	0.4	1.30	100	1.0	13.0	7.7	1.2	1.5
RDN11	bT?	12	34	0.6	1.50	62	1.0	12.0	7.2	0.6	1.2
RDN12	bT	8	50	0.4	1.00	160	0.3	20.5	9.2	0.9	1.2
RDN13	aT?	11	37	0.3	1.50	150	0.4	9.5	6.6	2.8	0.9
RDN14	bT	13	36	0.6	1.60	79	0.7	10.0	6.6	1.5	1.1
RDN15	bT	11	38	0.4	1.80	130	0.6	11.0	6.3	2.5	1.1
RDP02	bT	15	46	0.7	1.80	81	1.2	10.0	8.7	1.4	1.6
RDP03	bT	12	45	0.6	1.70	98	1.0	12.0	8.9	1.4	1.4
RDP04	bT	14	38	0.6	1.80	85	0.7	8.7	7.0	1.2	1.1
RDP05	aT	15	49	0.8	1.80	80	1.0	12.0	10.0	1.2	2.0
RDP06	bT	12	36	0.6	1.50	80	0.5	11.0	6.6	1.0	1.1
RDP07	bT	12	45	0.5	1.40	80	0.8	12.0	8.2	1.5	1.0
RDP08	bT	14	47	0.6	1.60	91	0.9	12.0	8.7	1.5	1.5
RDP09	aT	18	32	0.5	1.60	63	0.9	8.3	6.8	1.1	1.1
RDP10	bT	10	32	0.4	1.10	87	0.7	11.0	7.2	1.1	0.9
RDP11	bT	11	40	0.5	1.50	91	0.9	13.0	8.1	1.4	1.2
RDP12	bT	8	40	0.5	1.30	120	1.3	16.0	7.6	1.3	1.3
RDP13	bT	14	45	0.6	1.60	92	0.5	14.0	8.3	1.7	1.0
RDP14	aT	14	36	0.6	1.80	87	0.7	11.0	6.7	1.3	0.9
RDP15	bT	14	37	0.6	1.60	79	0.6	11.0	6.7	1.3	1.0
RDQ02	bT	14	51	0.6	1.70	96	0.8	12.0	9.2	1.5	1.5
RDQ03	bT	14	51	0.6	1.80	100	1.0	12.0	9.3	1.3	1.6
RDQ04	bT	11	45	0.6	1.50	110	0.7	15.0	8.3	1.1	1.4
RDQ05	bT	18	42	0.7	1.80	75	0.8	10.0	7.7	1.2	1.2
RDQ06	bT	11	53	0.5	1.40	110	1.2	12.0	10.0	1.4	1.5
RDQ07	aT	16	47	0.6	1.40	87	1.2	10.0	9.2	1.5	1.5

APPENDIX 4b: Geochemical results from INAA analysis of till samples (Hf - Tb) Continued

Sample ID	Till Type	Hf ppm	La ppm	Lu ppm	Na %	Rb ppm	Sb ppm	Sc ppm	Sm ppm	Ta ppm	Tb ppm
RDQ09	bT	15	55	0.7	1.50	87	0.6	12.0	10.2	1.3	1.4
RDQ10	bT	8	42	0.5	1.00	110	0.9	16.0	7.2	0.8	1.0
RDQ11	bT	14	45	0.6	1.60	93	0.6	14.0	8.8	1.3	1.5
RDQ12	bT	14	42	0.7	1.70	86	1.0	13.0	8.1	1.5	1.4
RDQ13	bT?	12	36	0.6	1.50	75	0.7	13.0	6.5	1.0	1.3
RDQ14	bT	13	40	0.6	1.60	86	0.6	12.0	7.3	1.5	1.5
RDQ15	bT	12	34	0.6	1.40	97	0.7	12.0	7.1	1.1	0.9
RDR02	bT	14	47	0.6	1.80	83	0.6	10.0	8.6	1.3	1.1
RDR03	bT	14	46	0.7	1.70	99	0.8	10.0	9.0	1.4	1.4
RDR04	bT	15	51	0.6	1.50	86	1.0	11.0	11.5	1.5	1.7
RDR05	bT?	12	44	0.6	1.60	91	0.8	12.0	8.8	1.3	1.3
RDR06	bT?	12	53	0.6	1.40	110	1.4	12.0	10.0	1.1	1.3
RDR07	bT	9	53	0.6	1.30	130	2.0	15.0	10.3	1.3	1.4
RDR08	bT	15	38	0.5	1.50	72	1.2	10.0	7.5	1.2	1.4
RDR09	bT?	11	40	0.6	1.20	150	0.9	17.0	7.1	1.8	1.0
RDR10	bT	12	45	0.6	1.40	120	0.8	15.0	8.8	1.4	1.3
RDR11	bT	14	52	0.6	1.50	98	0.5	14.0	10.0	1.6	1.8
RDR12	bT	10	35	0.4	1.30	100	0.7	14.0	6.4	1.4	0.9
RDR12FD	bT	10	38	0.5	1.40	110	0.8	15.0	6.9	1.5	1.2
RDR13	bT	11	35	0.4	1.30	82	0.7	12.0	5.9	1.4	0.9
RDR14	aTv	7	36	0.4	0.83	94	1.9	15.0	6.4	1.1	1.1
RDR15	bT	8	33	0.3	1.00	110	0.8	12.0	6.4	1.3	0.9
RDS02	bT	14	37	0.5	1.30	62	0.8	7.9	6.3	1.3	1.1
RDS03	bT	15	47	0.6	1.60	73	1.1	9.4	10.0	1.7	1.6
RDS04	bT	14	48	0.6	1.60	93	0.9	11.0	9.2	1.5	1.5
RDS05	aT?	11	38	0.4	1.00	86	2.3	10.0	6.8	1.1	1.0
RDS06	bT	10	49	0.6	1.00	130	1.9	13.0	8.5	1.3	1.3
RDS07	bT	12	52	0.6	1.00	120	1.4	12.0	9.3	1.4	1.5
RDS07.5	bT	11	51	0.5	1.50	100	1.4	13.0	10.0	1.3	1.5
RDS08	bT	10	53	0.5	1.30	96	1.6	13.0	10.0	1.6	1.4
RDS09	bT	9	34	0.5	1.10	130	0.7	15.0	6.6	1.5	0.9
RDS10	bT	10	45	0.5	1.10	110	0.6	12.0	10.0	1.3	1.6
RDS11	bT	10	36	0.5	1.40	100	0.8	12.0	6.8	1.2	1.1
RDS12	bT	12	39	0.5	1.40	95	0.7	13.0	7.3	1.2	1.1
RDS12FD	bT	11	39	0.5	1.30	100	0.7	13.0	7.2	1.3	0.8
RDS13	bT	12	39	0.5	1.50	100	0.9	12.0	7.1	1.4	1.0
RDS14	bT?	11	44	0.5	1.50	88	1.0	13.0	7.7	1.8	1.2
RDS15	bT	10	42	0.6	1.40	120	1.3	15.0	8.4	1.5	1.2
RDT02	bT	13	46	0.6	1.30	120	6.6	11.0	8.9	1.7	1.3
RDT03	bT	14	47	0.6	1.40	95	1.2	11.0	8.5	1.4	1.3
RDT04	aT	13	46	0.6	1.30	88	2.3	12.0	8.5	-0.5	1.2
RDT05	bT	9	43	0.4	0.88	140	1.7	13.0	8.1	1.6	1.2
RDT06	bT	10	47	0.5	1.10	120	1.4	12.0	10.0	1.3	1.6
RDT07	aT	14	63	0.8	1.40	120	2.6	13.0	12.9	1.8	1.8
RDT08	aT	12	49	0.6	1.10	120	2.0	15.0	10.0	1.6	1.9

APPENDIX 4b: Geochemical results from INAA analysis of till samples (Hf - Tb) Continued

Sample	Till	Hf	La	Lu	Na	Rb	Sb	Sc	Sm	Ta	Tb
ID	Type	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
RDT09	bT	14	48	0.5	1.40	92	1.2	13.0	9.0	1.6	1.6
RDT9.5	bT	9	43	0.5	1.30	110	0.8	14.0	8.1	1.4	1.2
RDT10	bT	14	39	0.6	1.40	92	0.9	12.0	7.9	1.1	1.4
RDT11	bT	8	29	0.3	0.79	90	4.5	12.0	4.8	0.8	0.7
RDT12	bT	12	42	0.6	1.40	100	1.5	13.0	8.3	1.1	1.5
RDT13	bT	13	41	0.5	1.40	87	1.0	11.0	7.6	1.2	1.0
RDT14	bT	11	34	0.3	1.30	98	0.8	12.0	6.0	1.2	1.0
RDT15	bT	11	37	0.4	1.20	110	0.9	12.0	7.2	1.6	1.2
RDV02a	bT	16	53	0.7	1.10	120	10.7	13.0	10.4	1.5	1.6
RDV02b	bT	13	49	0.7	1.20	110	9.1	11.0	10.0	1.5	1.6
RDV03	bT	11	46	0.5	1.40	120	1.7	15.0	8.4	1.5	1.4
RDV03FD	bT	12	53	0.7	1.40	120	2.1	15.0	10.0	1.4	1.2
RDV04	bT	12	49	0.6	1.60	110	1.3	12.0	9.4	1.5	1.6
RDV05	bT	11	50	0.6	1.70	99	1.1	12.0	9.2	1.5	1.3
RDV06	bT	12	56	0.6	1.20	140	1.9	13.0	10.0	1.8	1.6
RDV07a	aT?	15	55	0.7	1.60	97	1.1	12.0	10.0	1.3	1.3
RDV07b	bT	11	53	0.7	1.10	120	1.3	13.0	9.4	1.4	1.2
RDV08	bT	9	43	0.6	0.95	140	1.0	14.0	7.8	1.8	1.2
RDV09	bT	11	49	0.5	1.20	93	1.1	13.0	10.0	1.1	1.7
RDV10	aT	13	38	0.5	1.00	74	1.3	12.0	7.4	1.7	1.3
RDV11	aT?	12	37	0.6	1.30	86	0.7	11.0	7.0	1.4	1.2
RDV12	bT	15	40	0.6	1.60	81	1.4	11.0	8.4	1.5	1.7
RDV13	bT	12	44	0.6	1.70	94	1.2	13.0	8.7	1.3	1.4
RDV14	bT	10	34	0.5	1.30	80	0.9	13.0	5.9	1.3	0.8
RDV15	bT	15	44	0.7	1.70	75	0.9	12.0	8.5	1.3	1.4
RDW02	bT	13	43	0.5	1.50	96	0.9	13.0	7.5	1.3	1.1
RDW03	bT	19	53	0.7	1.10	110	1.7	14.0	10.0	1.1	1.3
RDW04	bT	14	53	0.7	1.50	100	1.1	16.0	10.0	0.8	1.6
RDW05	bT	14	45	0.5	1.50	100	0.9	11.0	8.1	1.6	1.1
RDW06	bT	11	47	0.5	1.20	130	1.3	14.0	9.4	1.8	1.4
RDW07	aT	20	71	0.8	1.40	110	1.3	13.0	12.4	1.6	1.7
RDW08	bT?	10	58	0.8	1.20	130	1.5	15.0	10.7	1.3	1.5
RDW09	bT	12	46	0.7	1.20	110	0.8	14.0	8.4	1.4	1.3
RDW10	bT	11	38	0.6	1.20	100	0.6	12.0	6.9	1.7	1.0
RDW11	bT	11	49	0.7	1.40	120	1.8	15.0	9.2	1.3	1.6
RDW12	bT	14	39	0.6	1.50	95	1.3	13.0	7.0	1.2	1.0
RDW13	bT	13	44	0.6	1.40	110	0.9	13.0	7.6	1.5	1.3
RDW14	bT	13	38	0.4	1.50	91	0.8	13.0	6.6	1.5	1.0
RDW15	bT	14	47	0.7	1.70	92	0.8	14.0	8.9	1.4	1.4
RDX02	bT	12	39	0.5	1.30	100	1.0	10.0	7.3	1.4	1.0
RDX03	bT	11	42	0.6	1.30	96	1.3	11.0	9.2	1.5	1.4
RDX04	bT?	11	40	0.5	1.40	100	1.9	13.0	7.7	1.3	1.2
RDX05	bT?	12	46	0.6	1.60	110	1.1	12.0	8.4	1.5	1.2
RDX06	bT	13	62	0.8	1.40	120	1.6	13.0	11.9	1.5	1.8
RDX07	bT	10	45	0.6	1.10	150	0.8	14.0	7.9	1.6	1.6

APPENDIX 4b: Geochemical results from INAA analysis of till samples (Hf - Tb) Continued

Sample ID	**Till Type**	**Hf** ppm	**La** ppm	**Lu** ppm	**Na** %	**Rb** ppm	**Sb** ppm	**Sc** ppm	**Sm** ppm	**Ta** ppm	**Tb** ppm
RDX08	bT	10	45	0.6	1.40	130	1.2	14.0	8.2	1.5	1.2
RDX09	aT	8	56	0.7	0.91	150	11.4	15.0	10.0	1.4	1.4
RDX10a	aT	20	55	0.8	1.50	83	5.5	10.0	10.3	1.3	1.5
RDX10b	aT	16	60	0.8	1.40	110	4.4	13.0	11.8	1.9	1.7
RDX11	bT	11	44	0.5	1.20	140	3.5	16.0	8.2	1.6	1.3
RDX12-1	aT?	8	28	0.4	1.00	62	1.0	11.0	5.2	0.6	0.9
RDX12-2	aT?	9	31	0.5	1.00	85	1.4	10.0	6.4	1.0	1.2
RDX13	bT	11	37	0.6	1.50	70	1.2	13.0	7.0	0.5	1.3
RDX14	bT	12	36	0.5	1.50	87	1.1	13.0	6.7	1.0	1.3
RDX15	bT	14	37	0.6	1.80	79	1.0	13.0	7.4	1.2	1.2

APPENDIX 4b: INAA results (Th - Yb)

Sample ID	**Till Type**	**Th** ppm	**U** ppm	**W** ppm	**Yb** ppm
RDA02	bT	13.0	3.3	1	3
RDA03-1	aT	12.0	3.3	1	4
RDA03-2	aT	13.0	3.9	2	4
RDA04	bT	14.0	4.4	2	4
RDB02	bT	13.0	3.2	1	3
RDB03	bT	11.0	3.2	1	3
RDB04	bT	11.0	2.9	1	3
RDB05	bT	12.0	3.3	1	4
RDB06	bT	12.0	4.2	2	4
RDB13	bT	11.0	2.5	-1	3
RDB14	bT	11.0	2.7	1	3
RDB15	bT	14.0	3.0	2	3
RDC02	aT	12.0	2.9	-1	3
RDC03	bT	12.0	2.8	-1	4
RDC04	bT	11.0	2.8	1	3
RDC05	bT	11.0	2.7	2	3
RDC06	bT	11.0	2.7	1	3
RDC07	aT	12.0	3.4	2	4
RDC12	bT	11.0	2.7	1	3
RDC13	bT	11.0	3.0	1	3
RDC14	bT	10.0	2.7	1	3
RDC15	bT	12.0	2.9	1	2
RDCD11	bT	13.0	2.8	2	3
RDD02	aT	13.0	3.2	2	3
RDD03	bT	13.0	3.9	1	4
RDD04	bT	12.0	3.3	2	3
RDD05	aT	14.0	3.2	2	4
RDD06	bT	16.0	3.5	1	3
RDD07	bT	13.0	3.1	1	3

APPENDIX 4b: INAA results (Th - Yb) Continued					
Sample ID	**Till Type**	**Th** ppm	**U** ppm	**W** ppm	**Yb** ppm
RDD08	aT	14.0	3.7	2	4
RDD09	bT	12.0	3.0	2	3
RDD10	bT	13.0	3.4	1	4
RDD12	bT	13.0	2.9	2	3
RDD13-1	bT	11.0	2.9	2	4
RDD13-2	bT	12.0	2.6	2	3
RDD14	bT	12.0	3.0	2	3
RDD15	bT	11.0	2.8	1	3
RDE02	bT	12.0	3.1	1	3
RDE03	bT	13.0	3.2	1	4
RDE04	bT	11.0	3.0	1	3
RDE05	bT	12.0	2.5	2	3
RDE07	bT	11.0	3.6	2	3
RDE08	bT	12.0	3.6	2	3
RDE09	bT	14.0	7.0	-1	4
RDE10	bT	12.0	3.3	2	3
RDE11	bT	12.0	3.0	1	3
RDE12	aT	13.0	3.5	1	3
RDE13	bT	11.0	3.0	1	3
RDE14	bT	12.0	3.3	1	4
RDE15	bT	12.0	2.7	1	3
RDEF06	bT	14.0	3.3	1	4
RDF02	aT	16.0	3.9	2	4
RDF03	bT	13.0	3.1	-1	3
RDF04	bT	15.0	4.0	2	3
RDF05	bT	16.0	3.7	2	4
RDF07	bT	13.0	3.4	1	4
RDF08	bT	11.0	2.9	2	3
RDF09	bT	14.0	3.4	1	4
RDF10	bT	14.0	3.6	2	4
RDF11	aT	15.0	3.0	1	4
RDF12	bT	9.1	2.7	1	3
RDF13	aT	10.0	2.7	1	3
RDF14	bT	11.0	2.5	-1	3
RDF15	bT	11.0	2.7	2	3
RDG02	bT	15.0	3.6	1	3
RDG03	bT	14.0	3.5	2	4
RDG04	bT	14.0	3.7	1	4
RDG05	bT?	14.0	3.8	-1	4
RDG06	aT	14.0	3.2	1	3
RDG07	bT?	13.0	3.2	-1	4
RDG08	bT	15.0	3.4	-1	3
RDG09	bT	13.0	3.0	2	4
RDG10	aT	12.0	3.2	2	3
RDG11	aT?	11.0	2.6	1	3

APPENDIX 4b: INAA results (Th - Yb) Continued

Sample ID	Till Type	Th ppm	U ppm	W ppm	Yb ppm
RDG12	bT	12.0	2.6	1	3
RDG12FD	bT	13.0	2.9	2	3
RDG13	bT	13.0	2.8	1	4
RDG14a	aT	12.0	3.3	3	3
RDG14b	bT	12.0	3.1	2	4
RDG15	aT	13.0	3.1	3	3
RDH02	bT	14.0	3.7	-1	4
RDH03	aT	15.0	3.8	1	4
RDH04	aT	12.0	3.0	-1	2
RDH05	bT?	19.0	6.0	2	5
RDH06	bT	16.0	3.6	2	5
RDH07	bT	11.0	3.4	-1	3
RDH08	bT	11.0	3.0	1	2
RDH09	bT	13.0	3.9	-1	4
RDH10	?	14.0	4.4	2	4
RDH11	bT	14.0	3.6	2	4
RDH12	bT	11.0	3.1	1	3
RDH13	bT	12.0	2.8	2	3
RDH14.5	bT	12.0	3.1	3	3
RDK02	bT	15.0	3.5	1	4
RDK03	bT	15.0	3.5	-1	3
RDK04	bT	15.0	3.8	2	4
RDK05	bT	14.0	3.4	-1	4
RDK06	aT	14.0	4.2	2	5
RDK07	aT	12.0	3.9	-1	4
RDK08	bT	13.0	3.0	-1	3
RDK09	bT	11.0	3.3	-1	3
RDK10	bT	12.0	3.2	1	4
RDK11	bT	13.0	3.7	-1	4
RDK12	aT?	16.0	3.9	5	4
RDK13	bT	12.0	2.8	3	3
RDK14	bT?	11.0	3.1	3	3
RDK15	bT	12.0	3.7	3	3
RDL02	aT	14.0	3.6	1	4
RDL03	bT	15.0	3.6	1	4
RDL04	bT	15.0	3.5	-1	4
RDL05	bT	13.0	7.9	2	4
RDL06	aT	14.0	3.6	1	4
RDL07	bT	16.0	5.1	2	5
RDL08	bT	12.0	3.0	1	4
RDL09	bT	13.0	2.8	2	3
RDL10	aT	13.0	3.3	1	3
RDL11a	aT	15.0	3.6	2	4
RDL11b	aT	16.0	5.2	2	4
RDL12	aT	16.0	4.1	3	4

APPENDIX 4b: INAA results (Th - Yb) Continued

Sample	**Till**	**Th**	**U**	**W**	**Yb**
ID	**Type**	ppm	ppm	ppm	ppm
RDL13	AT	28.5	4.9	8	4
RDL14	bT	15.0	4.0	3	4
RDL15	bT	15.0	4.0	-1	4
RDM02	aT	16.0	3.6	-1	4
RDM03	bT	12.0	3.8	2	4
RDM03FD	bT	13.0	3.8	1	4
RDM04	bT	15.0	3.4	2	4
RDM05	bT	12.0	3.1	-1	3
RDM06	bT	15.0	4.3	1	3
RDM07	bT	14.0	3.5	2	4
RDM08	bT	12.0	2.9	1	3
RDM09	bT	13.0	3.1	-1	3
RDM10	bT	12.0	2.9	1	3
RDM11	aT	14.0	3.3	2	4
RDM12	bT	12.0	3.4	28	4
RDM13	bT	12.0	2.7	2	3
RDM14	bT?	12.0	3.3	4	3
RDM15-1	aT	15.0	3.8	3	3
RDM15-2	bT	14.0	3.2	2	4
RDN02	bT	18.0	5.0	2	4
RDN03	aT	16.0	3.7	2	4
RDN04	bT	16.0	3.6	1	4
RDN05	bT	15.0	3.2	1	3
RDN06	bT	13.0	3.0	1	3
RDN07	aT	14.0	3.3	2	4
RDN08	aT	14.0	3.6	2	4
RDN09	bT	13.0	2.9	1	3
RDN10	bT	15.0	3.8	4	4
RDN11	bT?	13.0	3.4	15	3
RDN12	bT	18.0	4.4	3	3
RDN13	aT?	20.9	5.0	3	2
RDN14	bT	13.0	3.3	3	3
RDN15	bT	16.0	4.5	27	3
RDP02	bT	17.0	3.5	1	4
RDP03	bT	16.0	3.3	1	4
RDP04	bT	14.0	3.1	1	3
RDP05	aT	15.0	3.5	1	5
RDP06	bT	11.0	2.7	-1	3
RDP07	bT	14.0	3.0	3	4
RDP08	bT	16.0	3.4	1	4
RDP09	aT	11.0	3.0	1	4
RDP10	bT	12.0	2.8	2	3
RDP11	bT	13.0	3.6	3	4
RDP12	bT	14.0	3.0	2	3
RDP13	bT	16.0	3.8	3	4

APPENDIX 4b: INAA results (Th - Yb) Continued

Sample	Till	Th	U	W	Yb
ID	Type	ppm	ppm	ppm	ppm
RDP14	AT	14.0	3.3	4	3
RDP15	bT	12.0	3.4	3	3
RDQ02	bT	18.0	3.5	1	4
RDQ03	bT	17.0	3.3	2	5
RDQ04	bT	15.0	3.2	-1	4
RDQ05	bT	14.0	3.6	2	4
RDQ06	bT	17.0	3.9	3	4
RDQ07	aT	17.0	4.0	3	3
RDQ09	bT	20.5	3.9	3	3
RDQ10	bT	20.2	4.0	5	2
RDQ11	bT	15.0	4.7	2	4
RDQ12	bT	13.0	3.1	2	4
RDQ13	bT?	14.0	3.3	4	3
RDQ14	bT	14.0	3.3	2	4
RDQ15	bT	11.0	2.7	2	4
RDR02	bT	16.0	3.4	2	4
RDR03	bT	18.0	3.4	1	4
RDR04	bT	19.0	4.1	2	4
RDR05	bT?	15.0	3.2	2	3
RDR06	bT?	18.0	3.6	2	4
RDR07	bT	18.0	3.8	3	4
RDR08	bT	14.0	3.3	2	4
RDR09	bT?	23.3	4.4	2	4
RDR10	bT	14.0	3.0	1	4
RDR11	bT	16.0	5.1	2	4
RDR12	bT	13.0	3.0	-1	3
RDR12FD	bT	14.0	3.2	3	3
RDR13	bT	10.0	3.2	1	3
RDR14	aTv	13.0	3.4	3	3
RDR15	bT	12.0	2.7	2	2
RDS02	bT	14.0	3.4	3	3
RDS03	bT	17.0	3.4	4	4
RDS04	bT	17.0	3.6	2	4
RDS05	aT?	14.0	3.4	3	3
RDS06	bT	19.0	3.7	3	3
RDS07	bT	17.0	3.5	3	4
RDS07.5	bT	16.0	4.0	2	3
RDS08	bT	16.0	3.4	3	4
RDS09	bT	14.0	3.3	3	4
RDS10	bT	13.0	3.8	3	3
RDS11	bT	13.0	2.9	2	3
RDS12	bT	14.0	3.3	3	3
RDS12FD	bT	13.0	3.1	2	3
RDS13	bT	13.0	3.1	3	3
RDS14	bT?	14.0	3.5	2	3

APPENDIX 4b: INAA results (Th - Yb) Continued

Sample	Till	Th	U	W	Yb
ID	Type	ppm	ppm	ppm	ppm
RDS15	bT	14.0	3.2	2	4
RDT02	bT	15.0	3.9	17	4
RDT03	bT	18.0	3.8	4	3
RDT04	aT	19.0	3.9	7	4
RDT05	bT	17.0	3.9	5	3
RDT06	bT	17.0	3.9	3	3
RDT07	aT	21.6	4.2	3	4
RDT08	aT	19.0	5.2	3	4
RDT09	bT	18.0	4.3	3	4
RDT9.5	bT	17.0	3.6	3	3
RDT10	bT	14.0	3.6	2	4
RDT11	bT	17.0	3.6	3	2
RDT12	bT	16.0	3.4	1	4
RDT13	bT	13.0	3.1	3	3
RDT14	bT	11.0	2.8	2	3
RDT15	bT	14.0	3.4	2	3
RDV02a	bT	20.4	4.6	30	5
RDV02b	bT	16.0	4.1	26	4
RDV03	bT	17.0	3.4	3	3
RDV03FD	bT	18.0	3.5	3	4
RDV04	bT	18.0	3.6	5	4
RDV05	bT	16.0	3.6	2	4
RDV06	bT	19.0	3.9	5	4
RDV07a	aT?	19.0	4.1	3	4
RDV07b	bT	18.0	3.5	3	4
RDV08	bT	15.0	2.9	3	4
RDV09	bT	17.0	4.2	3	4
RDV10	aT	17.0	4.5	10	3
RDV11	aT?	13.0	3.5	2	3
RDV12	bT	13.0	3.6	2	4
RDV13	bT	13.0	3.1	2	4
RDV14	bT	12.0	2.8	2	3
RDV15	bT	16.0	4.1	2	4
RDW02	bT	15.0	3.5	2	3
RDW03	bT	19.0	4.2	5	5
RDW04	bT	16.0	4.1	5	5
RDW05	bT	18.0	3.7	4	3
RDW06	bT	18.0	3.6	2	3
RDW07	aT	25.3	5.0	4	5
RDW08	bT?	18.0	3.5	2	5
RDW09	bT	16.0	3.7	5	4
RDW10	bT	16.0	5.4	4	4
RDW11	bT	14.0	4.1	3	4
RDW12	bT	14.0	3.5	3	3
RDW13	bT	15.0	3.4	3	4

APPENDIX 4b: INAA results (Th - Yb) Continued

Sample ID	Till Type	Th ppm	U ppm	W ppm	Yb ppm
RDW14	bT	13.0	3.3	2	4
RDW15	bT	14.0	3.4	2	4
RDX02	bT	14.0	3.3	3	3
RDX03	bT	16.0	3.4	3	3
RDX04	bT?	18.0	3.6	5	3
RDX05	bT?	17.0	3.5	3	4
RDX06	bT	20.0	4.1	4	5
RDX07	bT	14.0	3.3	3	3
RDX08	bT	15.0	20.0	2	5
RDX09	aT	17.0	3.9	5	4
RDX10a	aT	18.0	4.6	5	5
RDX10b	aT	18.0	4.9	4	6
RDX11	bT	16.0	5.6	5	4
RDX12-1	aT?	12.0	3.1	2	3
RDX12-2	aT?	13.0	3.6	3	2
RDX13	bT	13.0	3.2	2	4
RDX14	bT	14.0	3.1	1	3
RDX15	bT	13.0	3.3	1	4

Part C: Precision and Accuracy of the Geochemical Data

To evaluate the precision and accuracy of the geochemical data, four geochemical reference standards, appropriately named Till-1, Till-2, Till-3 and LKSD-4, were obtained from the Geological Survey of Canada (GSC) and randomly included in the suite of samples to be examined. Each was accompanied by the "expected" values for selected elements as defined by the GSC (Lynch, 1990; 1996). Numerous analyses of these standards were performed using both ICP-MS and INAA.

Precision, referring to the quality of the instrumental analysis from which the data was obtained, or repeatability of the results, has been assessed by comparing the numerous analyses or "runs" of the samples. An error range is presented for each element to quantify the precision (e.g., Table IV-3). The quality of the analytical results, or accuracy, is quantified by assessing the degree of conformity of the analytical results with the standard values as defined by the GSC. Discrepancies from the standard "expected" values are presented as absolute deviations (e.g., Table IV-3). Where either an "expected" value or analytical result is below detection limits (noted as a "<") no deviations have been presented. Results from ICP-MS analyses of the GSC laboratory standards along with precision and accuracy are presented in Table IV-3 while those for INAA are presented in Table IV-4.

	Till-1						Till-2					
	First Run	Second Run	Precision (Range, ±)	Expected Value	Abs. Dev. 1st Run	Abs. Dev 2nd Run	First Run	Second Run	Precision (Range, ±)	Expected Value	Abs. Dev. 1st Run	Abs. Dev. 2nd Run
Ag (ppb)	197	195	2	200	-3	-5	201	218	17	200	1	18
As (ppm)	15	15.3	0.3	13	2	2.3	20.8	22.1	1.3	22	-1.2	0.1
Ba (ppm)	88.1	81.4	6.7	84	4.1	-2.6	84.9	91.3	6.4	95	-10.1	-3.7
Bi (ppm)	2.08	2.08	0	<3	n/a	n/a	5.14	5.28	0.14	4	1.14	1.28
Cd (ppm)	0.19	0.19	0	<0.2	n/a	n/a	0.28	0.32	0.04	0.3	-0.02	0.02
Co (ppm)	12.5	13.6	1.1	12	0.5	1.6	12.8	13.8	1	13	-0.2	0.8
Cr (ppm)	28.5	29.9	1.4	30	-1.5	-0.1	37.4	38.9	1.5	40	-2.6	-1.1
Cu (ppm)	42.95	43.7	0.75	48	-5.05	-4.3	139.88	141.06	1.18	149	-9.12	-7.94
Fe (%)	2.95	3.1	0.15	3.1	-0.15	0	3.16	3.05	0.11	3.2	-0.04	-0.15
Hg (ppb)	144	104	40	92	52	12	67	67	0	74	-7	-7
Mn (ppm)	1131	1157	26	950	181	207	666	659	7	530	136	129
Mo (ppm)	0.71	0.73	0.02	<2	n/a	n/a	12.57	13.39	0.82	11	1.57	2.39
Ni (ppm)	17.6	18.4	0.8	18	-0.4	0.4	30.2	31.5	1.3	31	-0.8	0.5
Pb (ppm)	14.86	15.05	0.19	12	2.86	3.05	24.28	24.92	0.64	21	3.28	3.92
V (ppm)	56	61	5	48	8	13	42	42	0	38	4	4
Zn (ppm	61.8	64.2	2.4	70	-8.2	-5.8	108.3	103.6	4.7	116	-7.7	-12.4

Table IV-3 - Results from ICP-MS analyses of laboratory standards obtained from the Geological Survey of Canada (GCS). Precision is presented as the error range among sample runs while accuracy is reported as absolute deviation from the expected value as defined by the GSC.

	Till-3					
	First Run	Second Run	Precision (Range, ±)	Expected Value	Abs. Dev. 1st Run	Abs. Dev. 2nd Run
Ag (ppb)	1266	1242	24	1600	-334	-358
As (ppm)	81.5	84.3	2.8	84	-2.5	0.3
Ba (ppm)	39.2	37.2	2	43	-3.8	-5.8
Bi (ppm)	0.31	0.33	0.02	<3	n/a	n/a
Cd (ppm)	0.08	0.09	0.01	<0.2	n/a	n/a
Co (ppm)	11.4	10.7	0.7	11	0.4	-0.3
Cr (ppm)	70.6	67.2	3.4	73	-2.4	-5.8
Cu (ppm)	19.86	20.78	0.92	23	-3.14	-2.22
Fe (%)	1.91	1.95	0.04	2	-0.09	-0.05
Hg (ppb)	100	102	2	107	-7	-5
Mn (ppm)	359	362	3	310	49	52
Mo (ppm)	0.62	0.59	0.03	<2	n/a	n/a
Ni (ppm)	32.7	31.9	0.8	32	0.7	-0.1
Pb (ppm)	18	18.61	0.61	16	2	2.61
V (ppm)	35	36	1	33	2	3
Zn (ppm	41	39.6	1.4	43	-2	-3.4

Table IV-3 - Continued

	LKSD-4									
	First Run	Second Run	Third Run	Fourth Run	Precision (Range, ±)	Expected Value	Abs. Dev. 1st Run	Abs. Dev. 2nd Run	Abs. Dev. 3rd Run	Abs. Dev. 4th Run
Ag (ppm)	212	192	197	212	20	200	12	-8	-3	12
As (ppm)	14.5	14.1	14.4	13.6	0.9	12	2.5	2.1	2.4	1.6
Cd (ppm)	1.93	1.83	1.89	1.98	0.15	1.9	0.03	-0.07	-0.01	0.08
Co (ppm)	11.3	10.2	9.7	11.5	1.8	11	0.3	-0.8	-1.3	0.5
Cr (ppm)	23.7	22.3	21.4	23.1	2.3	21	2.7	1.3	0.4	2.1
Cu (ppm)	30.39	30.13	30.18	30.45	0.32	30	0.39	0.13	0.18	0.45
Fe (%)	2.32	2.37	2.38	2.38	0.06	2.7	-0.38	-0.33	-0.32	-0.32
Hg (ppb)	169	166	172	164	8	190	-21	-24	-18	-26
Mn (ppm)	475	449	460	471	11	430	45	19	30	41
Mo (ppm)	1.74	1.7	1.73	1.7	0.04	2	-0.26	-0.3	-0.27	-0.3
Ni (ppm)	34.7	34.4	31.3	34.5	3.4	32	2.7	2.4	-0.7	2.5
Pb (ppm)	105.59	94.12	95.38	93.02	12.57	93	12.59	1.12	2.38	0.02
Sb (ppm)	1.28	1.19	1.16	1.21	0.12	1.5	-0.22	-0.31	-0.34	-0.29
V (ppm)	34	33	32	34	2	32	2	1	0	2
Zn (ppm	182.2	178.1	175.8	173	9.2	189	-6.8	-10.9	-13.2	-16

Table IV-3 - Continued

	Till-1						Till-2					
	First Run	Second Run	Precision (Range, ±)	Expected Value	Abs. Dev. 1st Run	Abs. Dev. 2nd Run	First Run	Second Run	Precision (Range, ±)	Expected Value	Abs. Dev. 1st Run	Abs. Dev. 2nd Run
As (ppm)	20	19	1	18	2	1	26	27	1	26	0	1
Au (ppb)	14	12	2	13	1	-1	-2	-2	0	2	-4	-4
Ba (ppm)	840	780	60	702	138	78	510	580	70	540	-30	40
Br (ppm)	6.9	6.7	0.2	6.4	0.5	0.3	12	13	1	12.2	-0.2	0.8
Ce (ppm)	83	75	8	71	12	4	120	110	10	98	22	12
Co (ppm)	20	19	1	18	2	1	18	16	2	15	3	1
Cr (ppm)	44	51	7	65	-21	-14	84	80	4	74	10	6
Cs (ppm)	1.1	0.9	0.2	1	0.1	-0.1	11	11	0	12	-1	-1
Eu (ppm)	1	2	1	1.3	-0.3	0.7	1	-1	2	1	0	-2
Fe (%)	5	4.9	0.1	4.81	0.19	0.09	3.8	4.2	0.4	3.84	-0.04	0.36
Hf (ppm)	13	13	0	13	0	0	10	10	0	11	-1	-1
La (ppm)	27	26	1	28	-1	-2	45	43	2	44	1	-1
Lu (ppm)	0.6	0.5	0.1	0.6	0	-0.1	0.6	0.6	0	0.6	0	0
Mo (ppm)	-1	-1	0	2	-3	-3	13	14	1	14	-1	0
Ni (ppm)	23	27	4	24	-1	3	33	36	3	32	1	4
Rb (ppm)	39	45	6	24	15	21	130	150	20	143	-13	7
Sb (ppm)	8.9	8.3	0.6	7.8	1.1	0.5	0.8	0.9	0.1	0.8	0	0.1
Sc (ppm)	14	14	0	13	1	1	12	11	1	12	0	-1
Sm (ppm)	6.7	6.2	0.5	5.9	0.8	0.3	7.7	8.3	0.6	7.4	0.3	0.9
Ta (ppm)	0.6	0.8	0.2	0.7	-0.1	0.1	1.8	2.1	0.3	1.9	-0.1	0.2
Tb (ppm)	1.3	1.4	0.1	1.1	0.2	0.3	1.6	1.4	0.2	1.2	0.4	0.2
Th (ppm)	6.2	5.6	0.6	5.6	0.6	0	19	20.6	1.6	18.4	0.6	2.2
U (ppm)	2.4	2.1	0.3	2.2	0.2	-0.1	5.7	6.2	0.5	5.7	0	0.5
W (ppm)	-1	-1	0	-1	0	0	4	4	0	5	-1	-1
Yb (ppm)	4	4	0	3.9	0.1	0.1	4	3	1	3.7	0.3	-0.7
Zn (ppm	120	120	0	98	22	22	130	-100	230	130	0	-230

Table IV-4 - Results from INA analyses of laboratory standards obtained from the Geological Survey of Canada (GCS). Precision is presented as the error range among sample runs while accuracy is reported as absolute deviation from the expected value as defined by the GSC.

	Till-3					
	First Run	Second Run	Precision (Range, ±)	Expected Value	Abs. Dev. 1st Run	Abs. Dev. 2nd Run
As (ppm)	95.7	95.4	0.3	87	8.7	8.4
Au (ppb)	4	-2	6	6	-2	-8
Ba (ppm)	560	520	40	489	71	31
Br (ppm)	5.2	5.5	0.3	4.5	0.7	1
Ce (ppm)	52	49	3	42	10	7
Co (ppm)	16	13	3	15	1	-2
Cr (ppm)	140	140	0	123	17	17
Cs (ppm)	1.7	1.5	0.2	1.7	0	-0.2
Eu (ppm)	-1	-1	0	-1	0	0
Fe (%)	3.1	3.2	0.1	2.78	0.32	0.42
Hf (ppm)	6	6	0	8	-2	-2
La (ppm)	20	20	0	21	-1	-1
Lu (ppm)	0.3	-0.2	0.5	0.2	0.1	-0.4
Mo (ppm)	-1	-1	0	2	-3	-3
Ni (ppm)	33	42	9	39	-6	3
Rb (ppm)	58	56	2	55	3	1
Sb (ppm)	0.9	0.9	0	0.9	0	0
Sc (ppm)	11	11	0	10	1	1
Sm (ppm)	3.8	3.7	0.1	3.3	0.5	0.4
Ta (ppm)	-0.5	-0.5	0	-0.5	0	0
Tb (ppm)	-0.5	-0.5	0	-0.5	0	0
Th (ppm)	5.3	5.2	0.1	4.6	0.7	0.6
U (ppm)	2	2.1	0.1	2.1	-0.1	0
W (ppm)	-1	-1	0	-1	0	0
Yb (ppm)	-2	2	4	1.5	-3.5	0.5
Zn (ppm	-100	-100	0	56	-156	-156

Table IV-4 - Continued

	LKSD-4									
	First Run	Second Run	Third Run	Fourth Run	Precision (Range, ±)	Expected Value	Abs. Dev. 1st Run	Abs. Dev. 2nd Run	Abs. Dev. 3rd Run	Abs. Dev. 4th Run
As (ppm)	15	16	15	16	1	16	-1	0	-1	0
Au (ppb)	5	-2	-2	5	n/a	2	3	-4	-4	3
Ba (ppm)	300	330	290	340	50	330	-30	0	-40	10
Br (ppm)	48	47	48	53.1	6.1	49	-1	-2	-1	4.1
Ce (ppm)	59	51	58	57	8	48	11	3	10	9
Co (ppm)	11	11	11	12	1	11	0	0	0	1
Cr (ppm)	38	34	-20	-20	n/a	33	5	1	-53	-53
Cs (ppm)	1.4	1.3	1.4	1.2	0.2	1.7	-0.3	-0.4	-0.3	-0.5
Eu (ppm)	-1	-1	1	-1	n/a	1.1	-2.1	-2.1	-0.1	-2.1
Fe (%)	2.8	3	3.1	3.3	0.5	2.8	0	0.2	0.3	0.5
Hf (ppm)	2	2	2	3	1	2.8	-0.8	-0.8	-0.8	0.2
La (ppm)	22	23	21	24	3	26	-4	-3	-5	-2
Lu (ppm)	-0.2	0.2	-0.2	-0.2	n/a	0.5	-0.7	-0.3	-0.7	-0.7
Mo (ppm)	-1	-1	2	-1	n/a	-5	4	4	7	4
Ni (ppm)	34	31	39	34	8	31	3	0	8	3
Rb (ppm)	14	16	12	18	6	28	-14	-12	-16	-10
Sb (ppm)	1.7	1.8	1.7	1.9	0.2	1.7	0	0.1	0	0.2
Sc (ppm)	6.5	6.8	6.8	7.2	0.7	7	-0.5	-0.2	-0.2	0.2
Sm (ppm)	4.2	4.4	4.1	4.6	0.5	5	-0.8	-0.6	-0.9	-0.4
Ta (ppm)	-0.5	-0.5	-0.5	-0.5	n/a	0.4	-0.9	-0.9	-0.9	-0.9
Tb (ppm)	-0.5	0.7	0.6	1	n/a	1.2	-1.7	-0.5	-0.6	-0.2
Th (ppm)	4.7	4.9	4.4	4.9	0.5	5.1	-0.4	-0.2	-0.7	-0.2
U (ppm)	29.3	29.7	28.8	31.6	2.8	31	-1.7	-1.3	-2.2	0.6
W (ppm)	-1	-1	2	-1	n/a	-4	3	3	6	3
Yb (ppm)	2	-2	2	2	0	2	0	-4	0	0
Zn (ppm)	170	150	180	280	130	194	-24	-44	-14	86

Table IV-4 - Continued

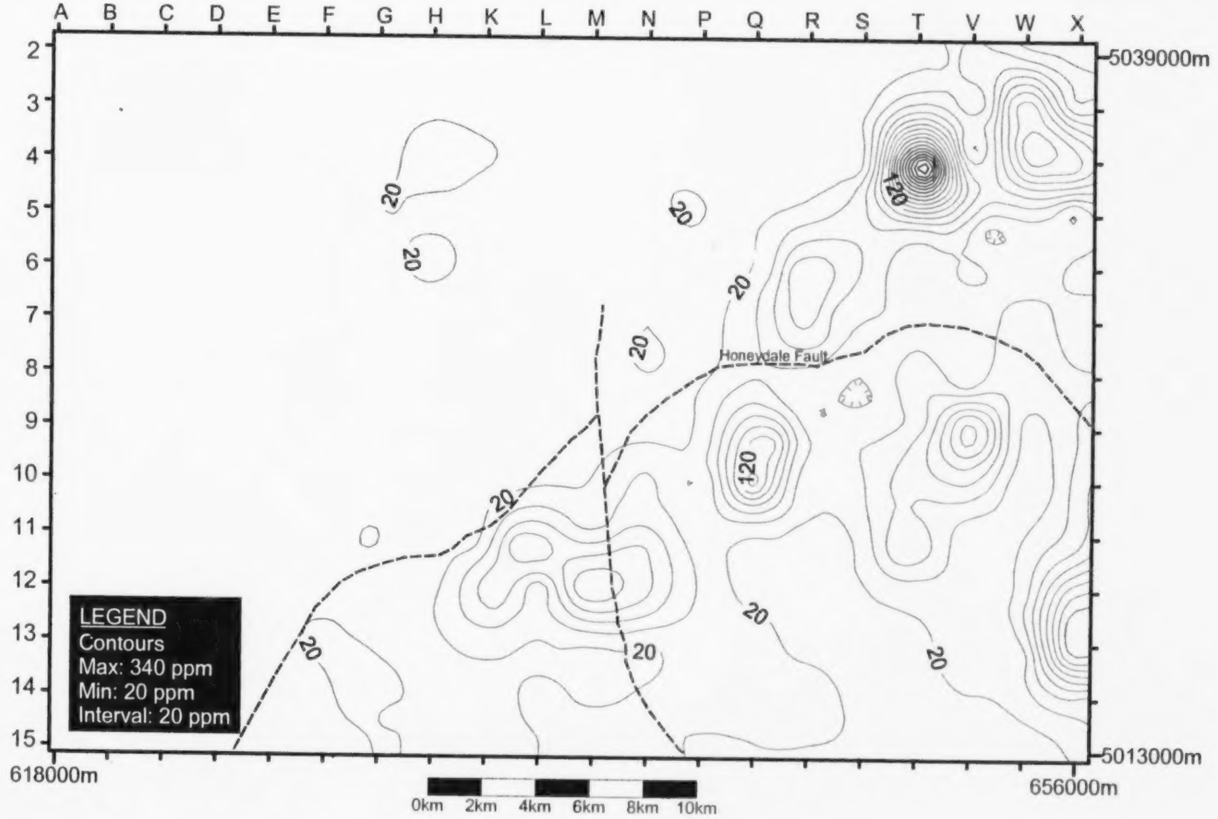

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
Honeydale Fault
120
120
20
LEGEND
Contours
Max: 340 ppm
Min: 20 ppm
Interval: 20 ppm
0km
2km
4km
6km
8km
10km

Fig. IV.a - Arsenic dispersal in the till matrix (ICP-MS).

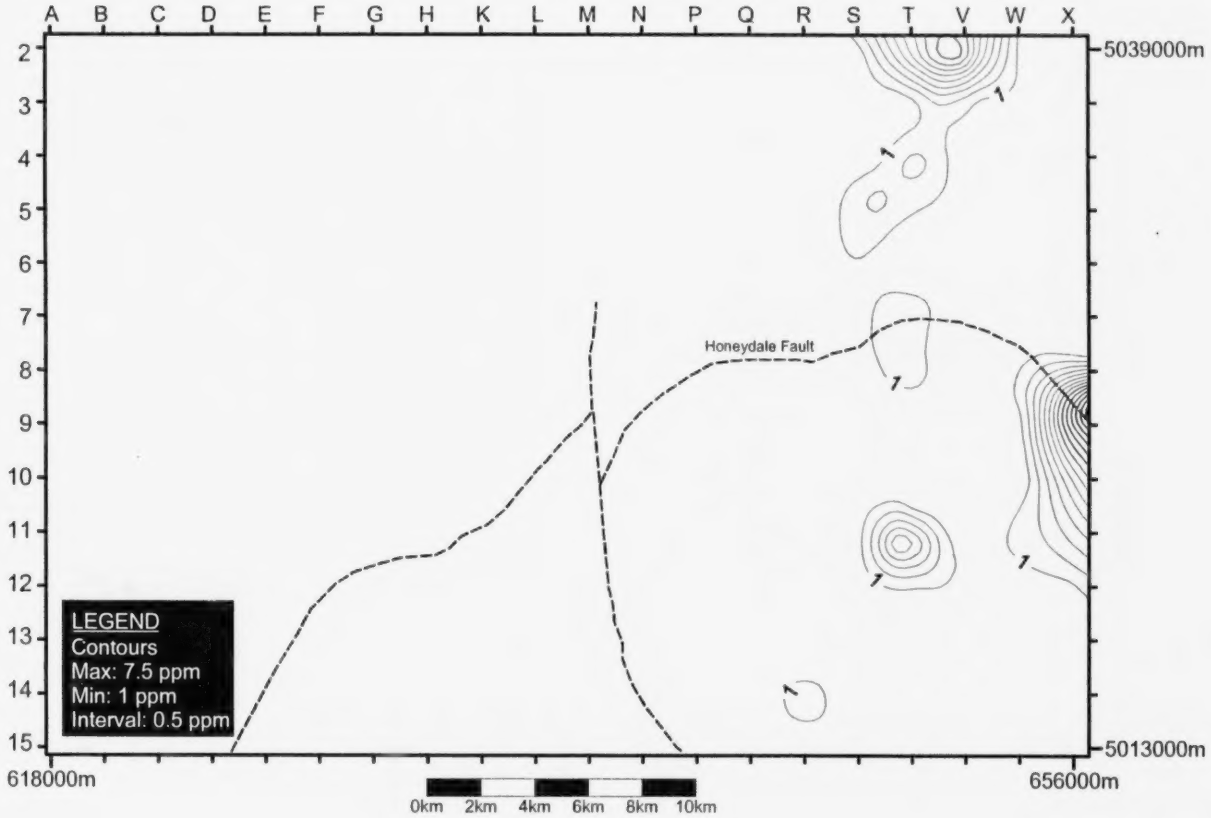

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
Honeydale Fault
1
LEGEND
Contours
Max: 7.5 ppm
Min: 1 ppm
Interval: 0.5 ppm
0km
2km
4km
6km
8km
10km

Fig. IV.b - Antimony dispersal in the till matrix (ICP-MS).

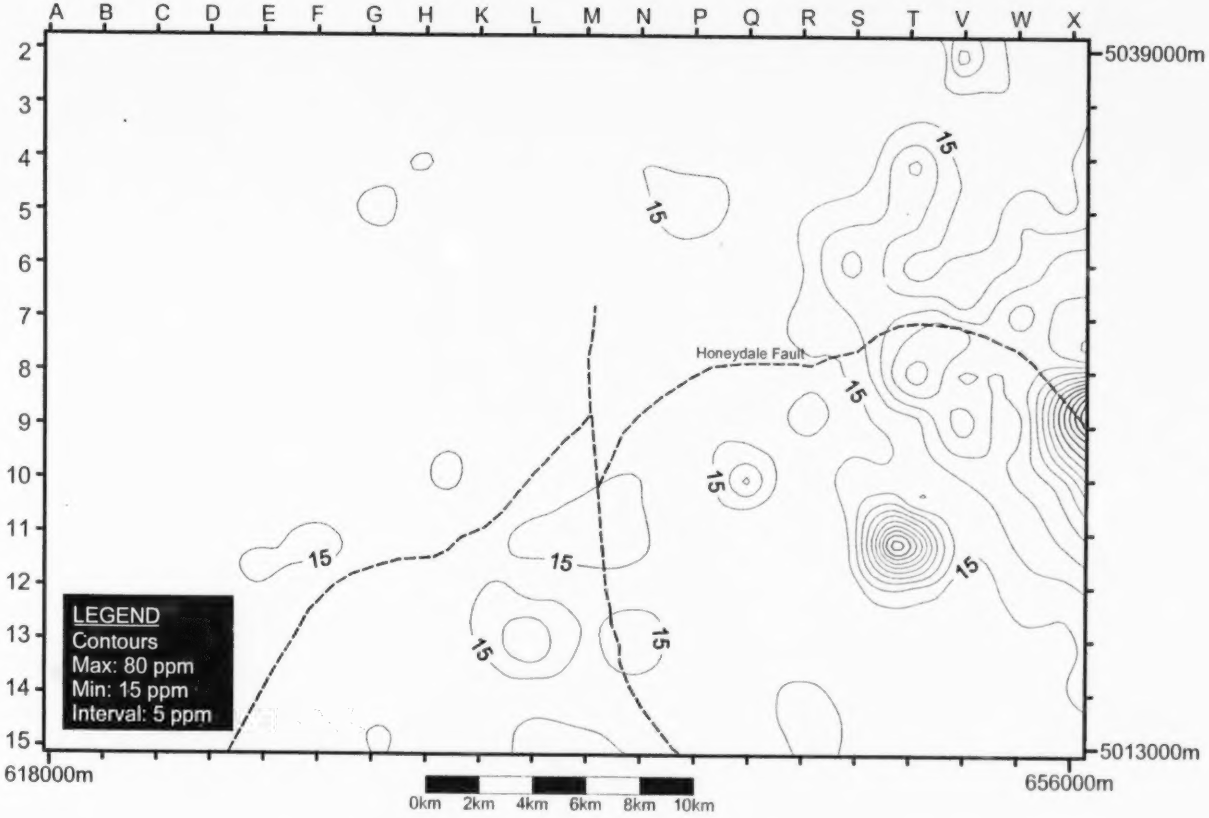

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
Honeydale Fault
15
LEGEND
Contours
Max: 80 ppm
Min: 15 ppm
Interval: 5 ppm
0km
2km
4km
6km
8km
10km

Fig. IV.c - Lead dispersal in the till matrix (ICP-MS).

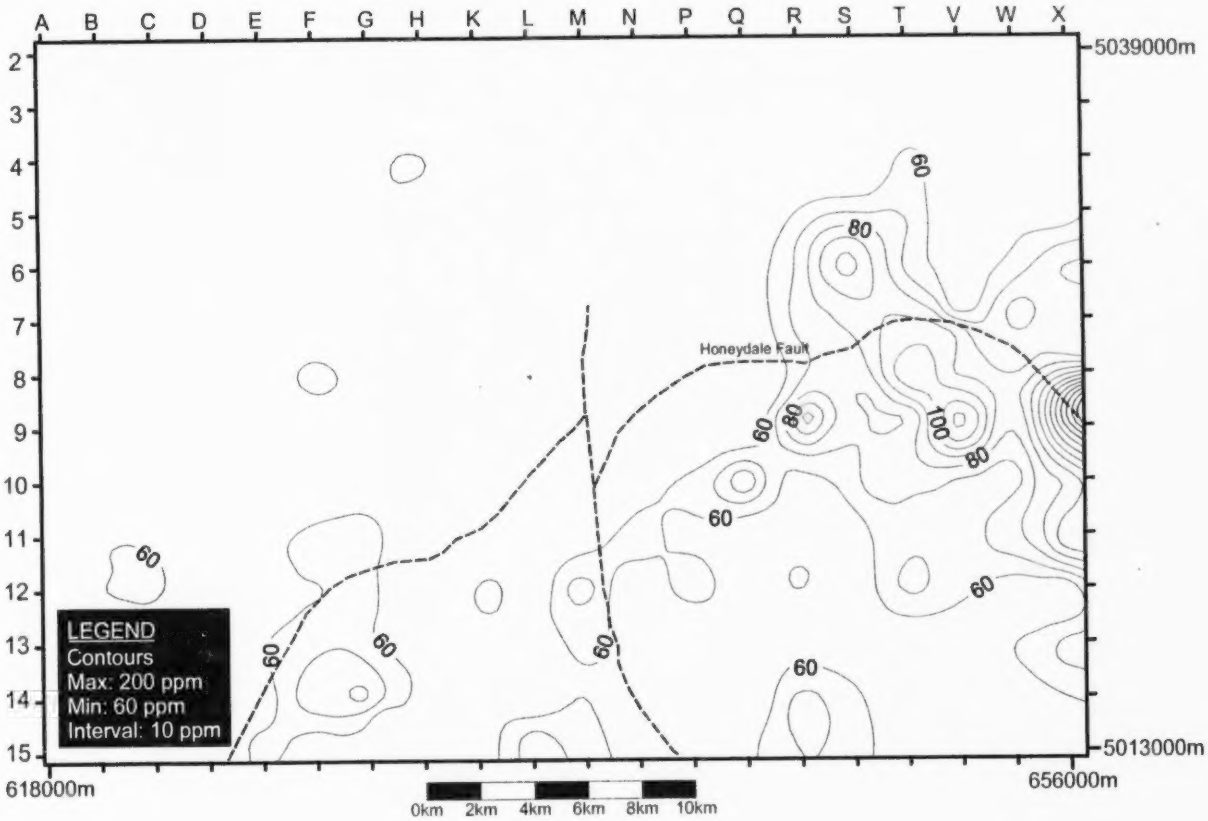

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
Honeydale Fault
60
80
100
LEGEND
Contours
Max: 200 ppm
Min: 60 ppm
Interval: 10 ppm
0km
2km
4km
6km
8km
10km

Fig. IV.d - Zinc dispersal in the till matrix (ICP-MS).

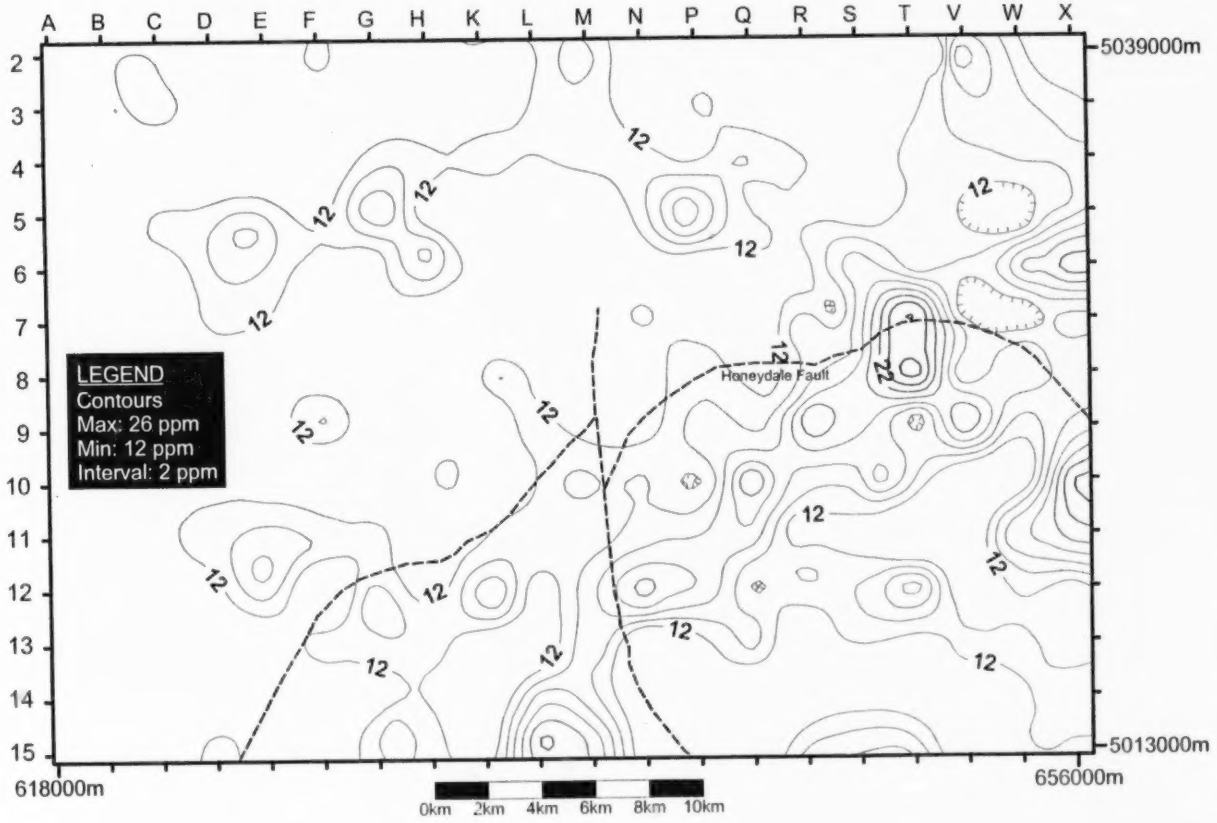

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
LEGEND
Contours
Max: 26 ppm
Min: 12 ppm
Interval: 2 ppm
12
22
Honeydale Fault
0km 2km 4km 6km 8km 10km

Fig. IV.e - Cobalt dispersal in the till matrix (ICP-MS).

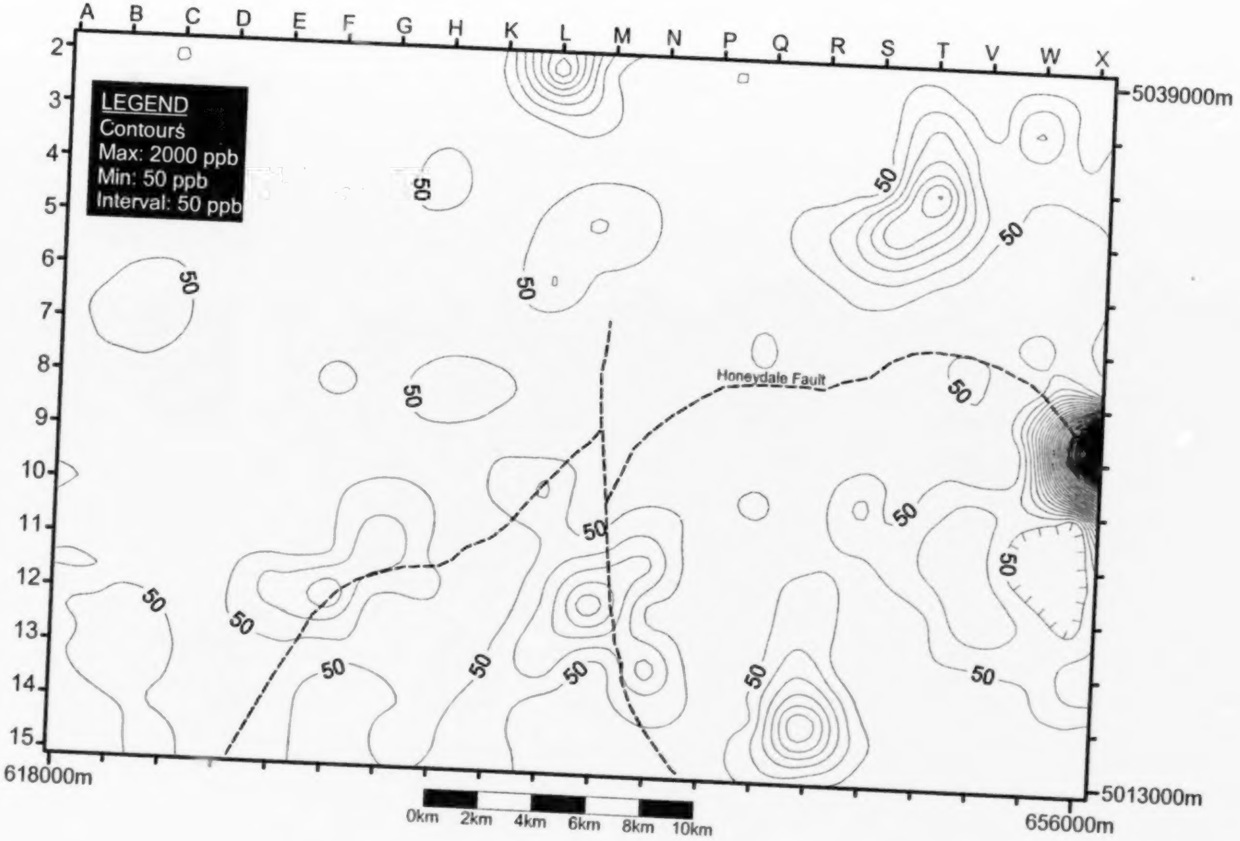

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
LEGEND
Contours
Max: 2000 ppb
Min: 50 ppb
Interval: 50 ppb
50
Honeydale Fault
5039000m
5013000m
618000m
656000m
0km 2km 4km 6km 8km 10km

Fig. IV.f - Silver dispersal in the till matrix (ICP-MS).

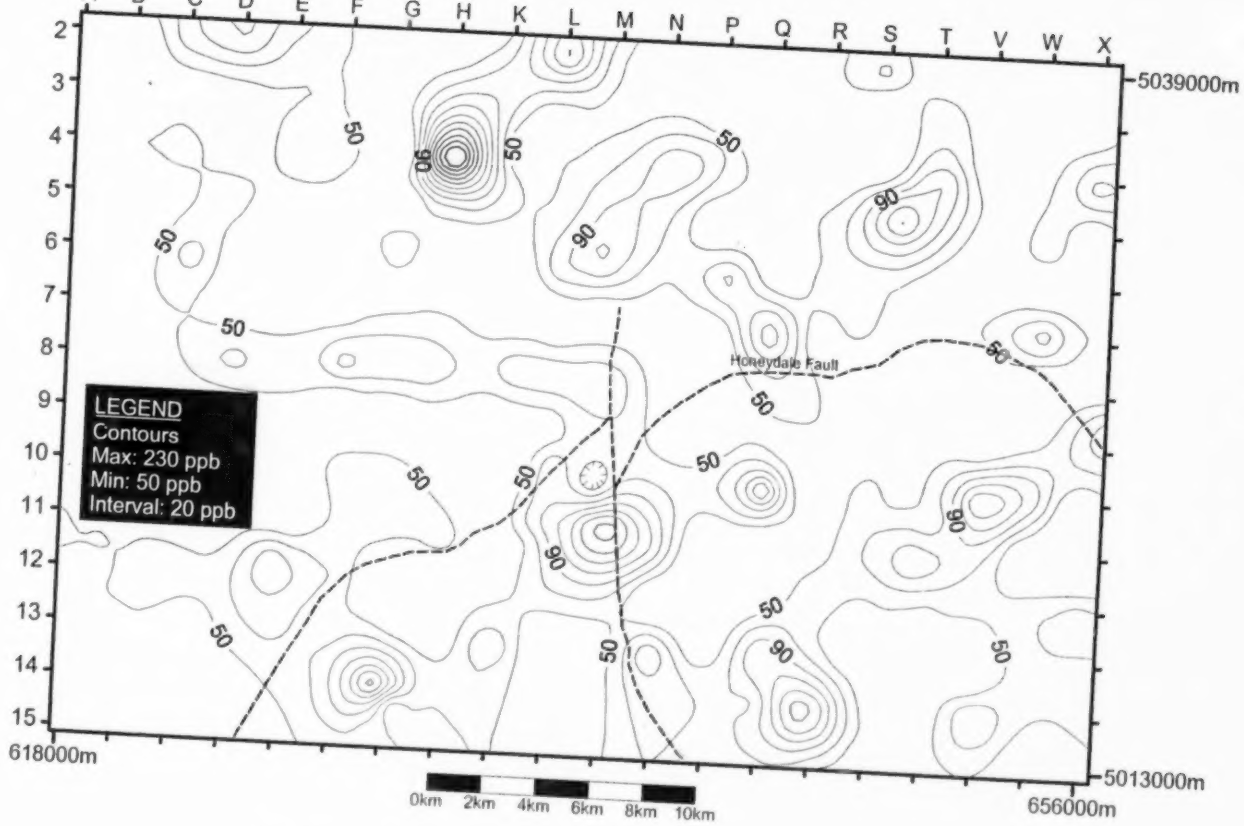

A B C D E F G H K L M N P Q R S T V W X
2 3 4 5 6 7 8 9 10 11 12 13 14 15
5039000m
5013000m
618000m
656000m
Honeydale Fault
50
90
LEGEND
Contours
Max: 230 ppb
Min: 50 ppb
Interval: 20 ppb
0km 2km 4km 6km 8km 10km

Fig. IV.g - Mercury dispersal in the till matrix (ICP-MS).

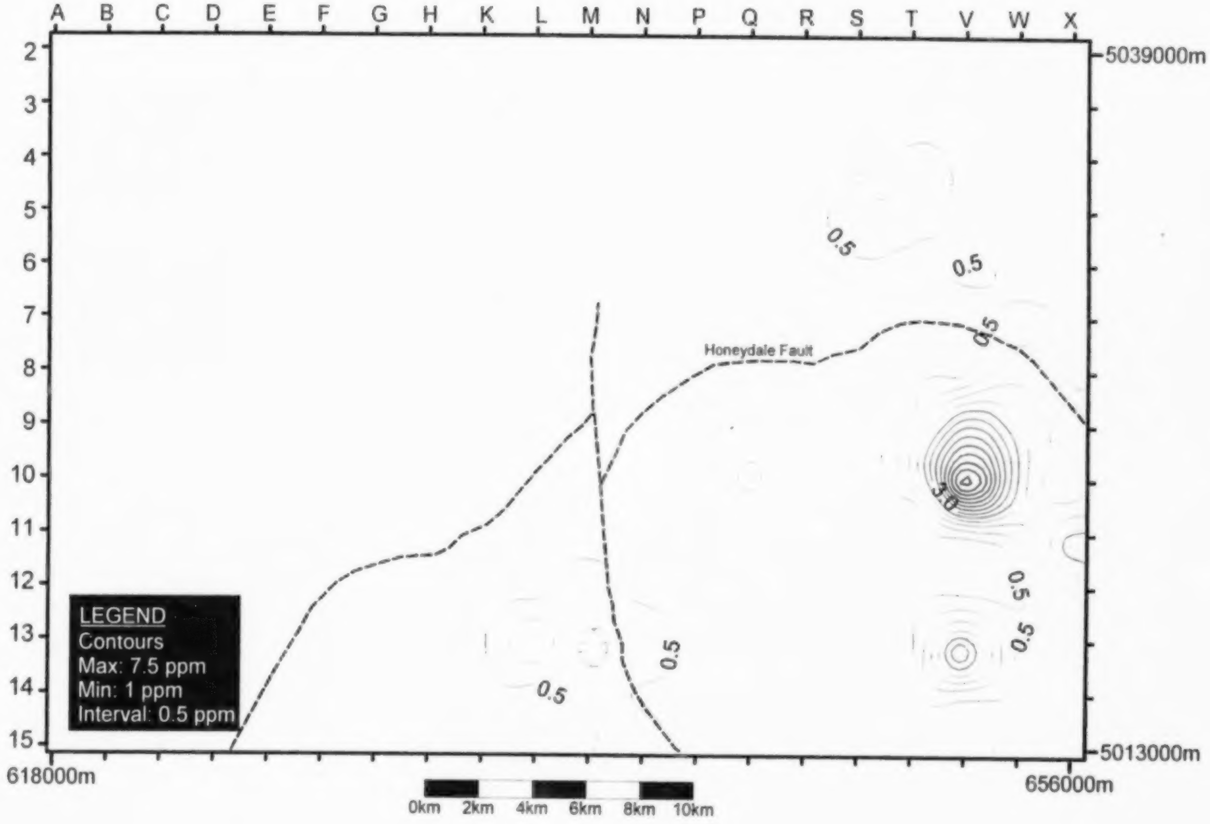

A
B
C
D
E
F
G
H
K
L
M
N
P
Q
R
S
T
V
W
X
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5039000m
5013000m
618000m
656000m
Honeydale Fault
0.5
3.0
LEGEND
Contours
Max: 7.5 ppm
Min: 1 ppm
Interval: 0.5 ppm
0km
2km
4km
6km
8km
10km

Fig. IV.h - Bismuth dispersal in the till matrix (ICP-MS).

APPENDIX V

Statistics and Histograms for Till Geochemistry

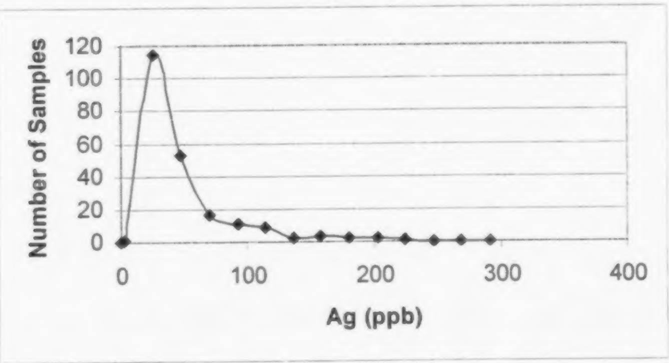
Statistical analyses were performed on 37 elements analyzed by ICP-MS and 12 additional elements analyzed by INAA. Because two genetically different types of sediment (basal till and ablation till) were collected in this survey, data processing was conducted on the basal till population alone. For comparative purposes, however, statistical analyses were also carried out on the combined basal till and ablation till data. This proved to be an important exercise, showing that there is no marked shift in the data set if the ablation till is included with the basal till.

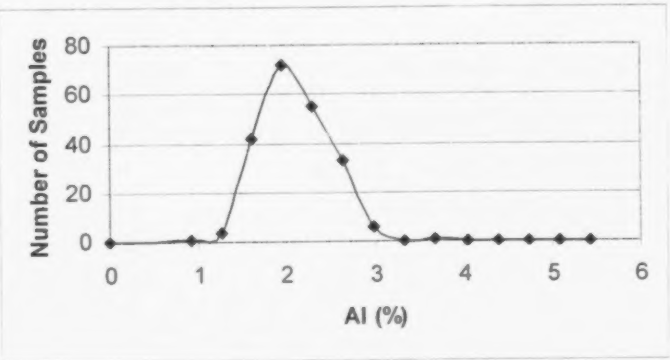
The basal till population was also split into two "sub-populations" for comparative purposes. During initial contouring of the geochemical data, it became apparent that background geochemical values for numerous elements were noticeably higher in the southeast portion of the study area, south of the Honeydale Fault (Fig. 1.5). Fyffe and Fricker (1987), in their tectonostratigraphic terrane analysis of New Brunswick, characterize the Honeydale Fault as the boundary separating the St. Croix terrane to the southeast and the Fredericton Cover Sequence to the northwest. By treating the till in these different terranes as separate populations (although genetically equivalent), it is clearly shown that background geochemical levels are higher in the St. Croix terrane for all metals and most other analyzed elements.

Elements are presented in alphabetical order and all statistical data presented in this section were computed using Microsoft Excel 97®.

	Ag (ppm)				Al (%)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	37.46	54.49	32.82	45.62	1.94	1.97	1.82	2.15
Std. Dev.	41.73	154.32	34.85	50.88	0.48	0.51	0.49	0.36
Skewness	2.85	12.96	2.64	2.66	2.53	1.94	3.77	0.67
Kurtosis	11.31	191.91	8.78	9.66	18.34	11.37	28.90	1.01
Percentiles								
Min	3.00	3.00	3.00	5.00	0.92	0.92	0.92	1.53
25th	12.00	13.00	11.00	13.25	1.67	1.68	1.51	1.90
50th	23.00	26.00	21.00	28.00	1.88	1.93	1.80	2.14
75th	45.00	50.50	41.00	50.00	2.21	2.24	2.04	2.36
80th	51.20	63.80	45.80	67.00	2.29	2.33	2.10	2.39
90th	87.00	103.00	72.40	109.50	2.43	2.49	2.34	2.56
95th	114.20	154.70	89.60	141.40	2.56	2.68	2.45	2.83
98th	162.16	280.40	158.68	169.66	2.84	3.25	2.57	2.95
99th	190.46	390.86	181.56	211.59	2.95	3.42	2.65	3.06
Max	314.00	2369.00	209.00	314.00	5.77	5.77	5.77	3.43

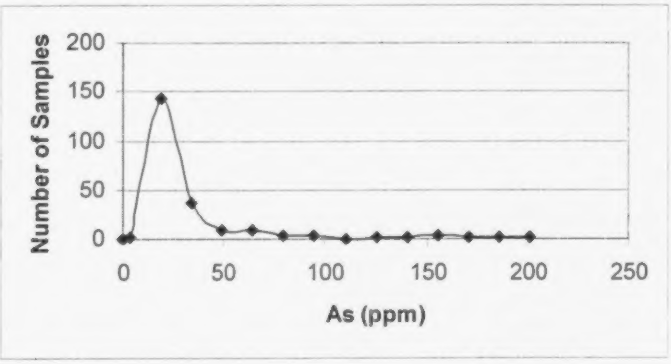
Histograms – Basal Till Population (aT sites excluded)

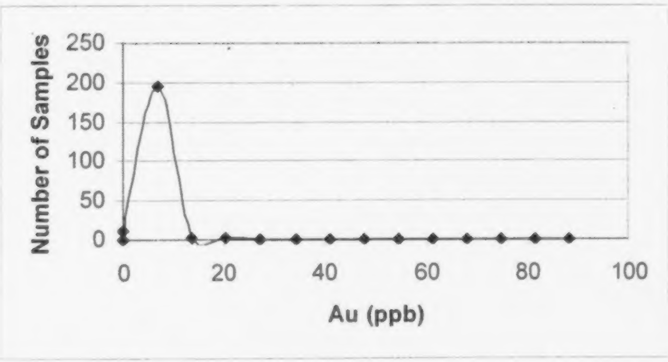




	As (ppm)				Au (ppb)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	24.91	28.30	19.17	34.98	2.35	2.27	1.75	3.41
Std. Dev.	33.04	40.27	27.74	38.90	7.14	6.46	3.38	10.95
Skewness	3.44	4.51	4.25	2.80	10.97	11.96	9.04	7.87
Kurtosis	12.96	29.01	20.04	8.37	136.02	163.96	93.13	65.73
Percentiles								
Min	3.70	3.70	3.70	6.90	0.10	0.10	0.10	0.10
25th	9.65	9.80	8.20	15.13	0.80	0.90	0.80	1.00
50th	13.60	14.70	10.90	21.70	1.30	1.30	1.20	1.40
75th	23.70	27.35	15.70	33.33	1.90	1.90	1.70	2.28
80th	28.30	33.04	18.78	42.62	2.30	2.30	1.98	2.42
90th	51.62	62.54	35.78	76.91	2.96	3.14	2.80	4.78
95th	88.80	92.93	57.36	131.69	5.73	5.67	3.40	7.01
98th	150.71	161.07	121.90	159.72	10.89	9.38	6.47	18.58
99th	174.22	183.35	160.56	184.99	18.82	18.50	10.44	36.40
Max	216.10	392.60	192.00	216.10	95.00	95.00	37.40	95.00

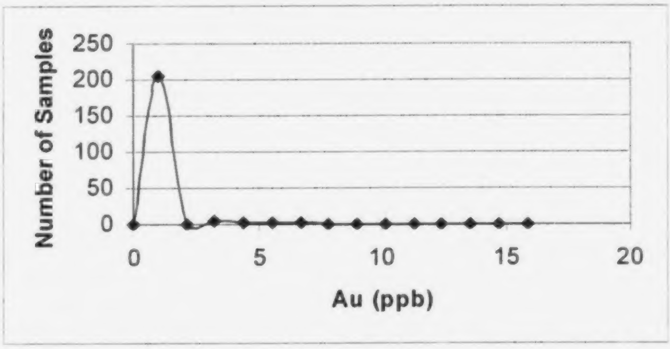
Histograms – Basal Till Population (aT sites excluded)

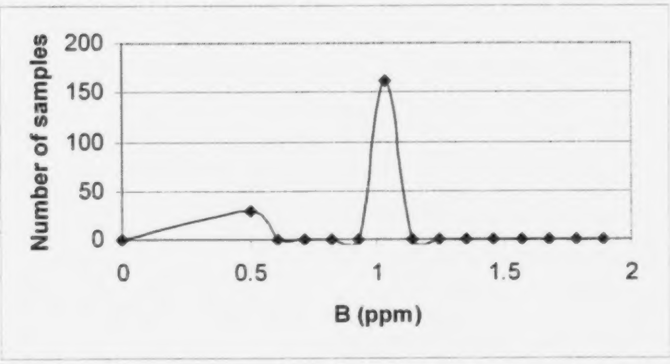




	Au (ppb)				B (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	INAA	INAA	INAA	INAA	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	1.37	1.47	1.22	1.64	1.04	1.03	1.04	1.04
Std. Dev.	1.79	1.91	1.30	2.42	0.38	0.36	0.35	0.42
Skewness	6.61	5.33	9.00	4.87	1.41	1.46	1.57	1.23
Kurtosis	48.23	32.42	91.62	25.93	2.33	2.74	3.23	1.40
Percentiles								
Min	1.00	1.00	1.00	1.00	0.50	0.50	0.50	0.50
25th	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50th	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
75th	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80th	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
90th	1.00	1.00	1.00	1.20	2.00	1.00	1.00	2.00
95th	3.00	4.45	1.95	6.00	2.00	2.00	2.00	2.00
98th	6.00	8.00	3.36	8.94	2.00	2.00	2.00	2.00
99th	11.53	10.87	5.00	13.84	2.00	2.00	2.00	2.00
Max	17.00	17.00	15.00	17.00	2.00	2.00	2.00	2.00

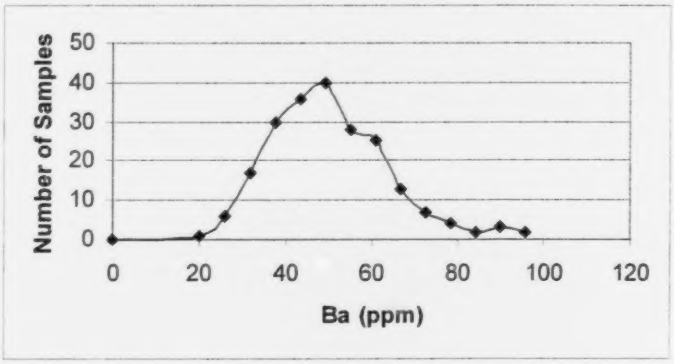
Histograms – Basal Till Population (aT sites excluded)

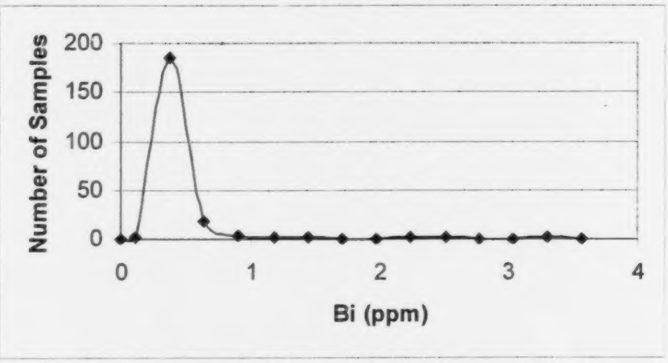




	Ba (ppm)				Bi (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	47.56	45.70	46.30	49.76	0.32	0.37	0.23	0.49
Std. Dev.	14.40	15.16	12.71	16.82	0.45	0.62	0.09	0.71
Skewness	0.88	0.91	0.54	0.96	6.02	7.80	2.22	3.61
Kurtosis	1.21	1.47	0.57	0.84	39.15	76.28	6.53	12.90
Percentiles								
Min	20.20	15.80	20.20	20.40	0.11	0.11	0.11	0.16
25th	37.65	34.80	38.10	36.85	0.18	0.19	0.17	0.23
50th	46.30	44.00	44.80	46.40	0.22	0.23	0.20	0.27
75th	55.80	53.55	53.50	57.70	0.29	0.30	0.24	0.36
80th	58.02	56.74	56.04	59.28	0.32	0.34	0.28	0.41
90th	65.50	63.98	62.88	71.52	0.42	0.49	0.34	0.72
95th	72.83	72.50	69.04	86.34	0.64	1.01	0.40	2.11
98th	87.99	87.87	73.04	90.64	1.85	1.91	0.48	3.35
99th	91.72	92.54	74.87	94.31	2.97	3.28	0.60	3.73
Max	101.70	104.70	93.40	101.70	3.84	7.60	0.68	3.84

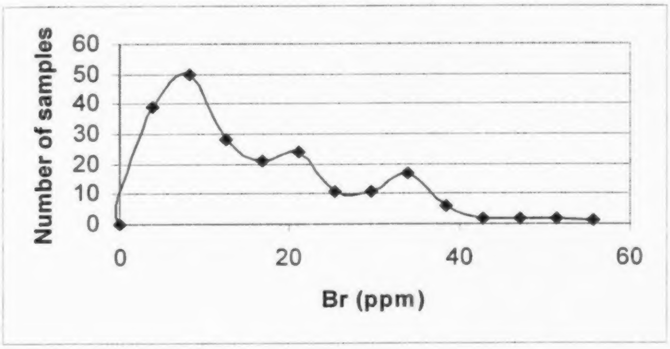
Histograms – Basal Till Population (aT sites excluded)

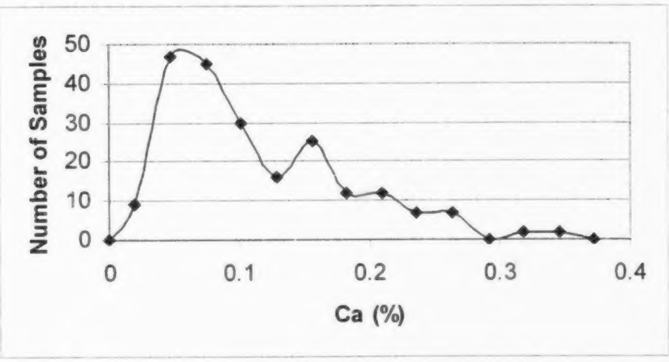




	Br (ppm)				Ca (%)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	IJNAA	INAA	INAA	INAA	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	14.16	15.33	11.94	18.11	0.10	0.10	0.11	0.09
Std. Dev.	12.43	14.01	10.16	14.95	0.07	0.07	0.07	0.07
Skewness	1.18	2.00	1.57	0.60	1.25	1.23	1.05	1.78
Kurtosis	1.17	7.95	3.32	-0.39	1.45	1.34	1.10	3.07
Percentiles								
Min	-0.50	-0.50	-0.50	-0.50	0.02	0.02	0.02	0.02
25th	4.33	4.68	4.33	4.45	0.04	0.04	0.05	0.04
50th	10.00	12.00	8.45	16.50	0.08	0.07	0.09	0.06
75th	21.00	22.25	17.00	30.25	0.14	0.14	0.15	0.11
80th	24.00	26.00	19.80	31.20	0.15	0.15	0.18	0.13
90th	32.00	33.00	25.80	35.10	0.20	0.20	0.21	0.18
95th	35.95	37.90	31.90	43.10	0.24	0.23	0.23	0.24
98th	48.02	50.59	37.00	52.48	0.30	0.26	0.26	0.32
99th	53.96	58.65	44.79	55.89	0.33	0.32	0.29	0.33
Max	60.00	111.00	58.10	60.00	0.40	0.40	0.40	0.34

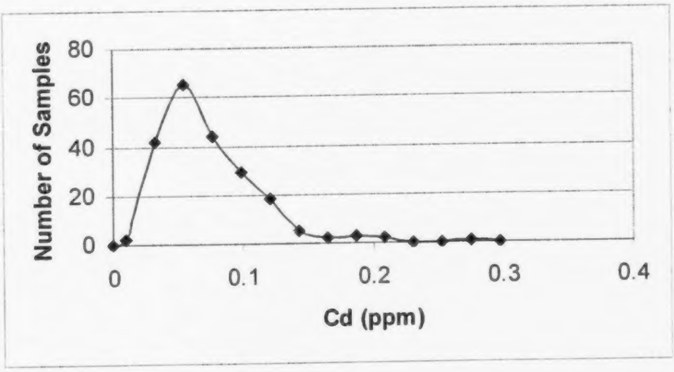
Histograms – Basal Till Population (aT sites excluded)

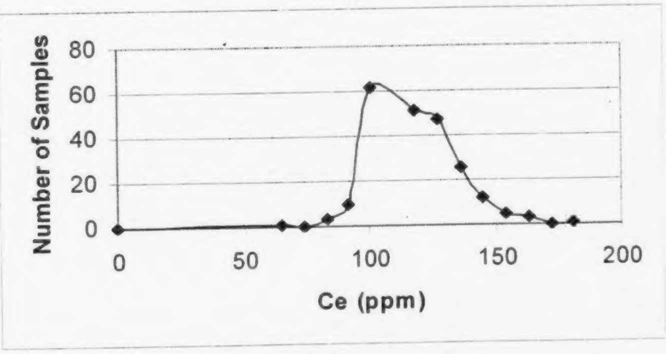




	Cd (ppm)				Ce (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	IJNAA	INAA	INAA	INAA
n of Values	222	272	142	80	222	272	142	80
Mean	0.07	0.07	0.05	0.09	113.43	114.07	115.35	110.04
Std. Dev.	0.04	0.06	0.03	0.06	17.64	18.61	17.35	17.75
Skewness	2.62	5.70	1.36	2.12	0.84	0.71	1.09	0.54
Kurtosis	10.27	53.41	2.88	5.45	1.91	1.41	2.90	0.25
Percentiles								
Min	0.01	0.01	0.01	0.02	65.00	65.00	76.00	65.00
25th	0.04	0.04	0.03	0.05	100.00	100.00	100.00	98.75
50th	0.05	0.06	0.05	0.08	110.00	110.00	110.00	110.00
75th	0.08	0.09	0.07	0.10	120.00	120.00	120.00	120.00
80th	0.09	0.09	0.07	0.11	130.00	130.00	130.00	120.00
90th	0.11	0.12	0.09	0.15	130.00	140.00	130.00	140.00
95th	0.14	0.15	0.11	0.19	140.00	150.00	140.00	140.00
98th	0.19	0.19	0.12	0.28	155.80	160.00	160.00	150.00
99th	0.26	0.28	0.13	0.30	160.00	170.00	171.80	152.10
Max	0.32	0.72	0.18	0.32	190.00	190.00	190.00	160.00

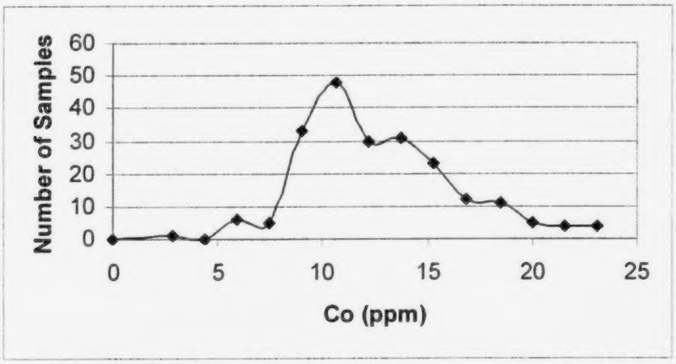
Histograms – Basal Till Population (aT sites excluded)

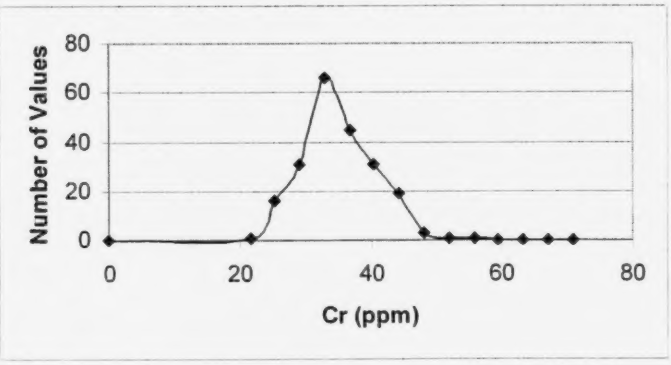




	Co (ppm)				**Cr (ppm)**			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	12.07	12.21	11.30	13.43	33.38	33.42	33.06	33.93
Std. Dev.	3.88	4.23	3.37	4.35	6.21	6.39	6.72	5.20
Skewness	0.81	1.14	0.90	0.49	1.63	1.23	1.99	0.39
Kurtosis	0.66	1.75	1.80	-0.40	8.28	5.91	9.92	-0.27
Percentiles								
Min	2.80	2.80	2.80	5.70	21.60	20.30	21.60	24.10
25th	9.50	9.40	9.20	10.23	29.70	29.50	29.00	30.28
50th	11.20	11.40	10.70	12.80	32.70	32.70	31.90	33.30
75th	14.30	14.30	13.20	15.60	37.05	37.40	36.40	37.48
80th	14.84	15.00	13.70	16.70	38.42	38.50	37.88	39.26
90th	17.66	17.92	15.18	19.82	40.80	40.84	40.00	40.83
95th	19.83	20.78	17.62	21.75	43.36	43.57	43.70	42.32
98th	21.92	23.58	19.83	22.85	44.47	44.91	45.31	43.59
99th	22.89	26.10	20.73	23.13	48.60	50.26	51.05	44.87
Max	24.70	28.50	24.70	23.90	74.60	74.60	74.60	48.80

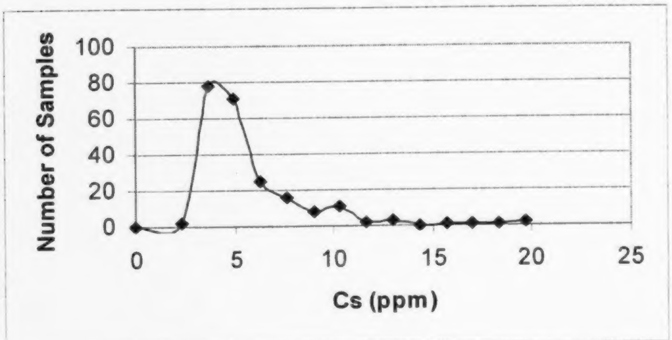
Histograms – Basal Till Population (aT sites excluded)

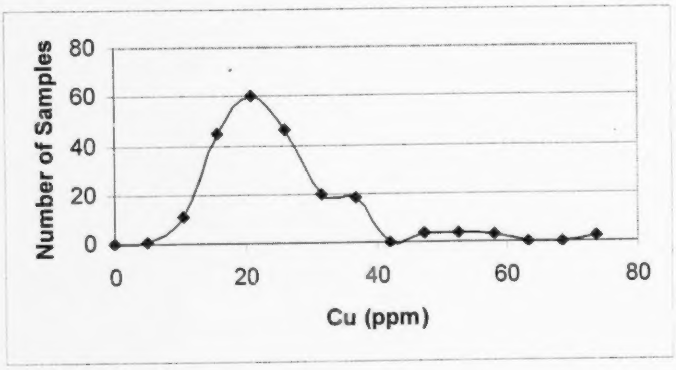




	Cs (ppm)				Cu (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	INAA	INAA	INAA	INAA	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	5.10	5.15	4.79	5.65	22.36	23.42	19.16	27.99
Std. Dev.	3.01	3.21	3.18	2.60	10.95	12.77	7.48	13.58
Skewness	2.64	2.70	2.64	3.20	2.08	2.84	1.33	1.76
Kurtosis	8.72	8.95	7.74	15.00	6.47	13.56	3.35	3.55
Percentiles								
Min	2.30	2.00	2.30	3.00	5.06	5.06	5.06	9.98
25th	3.30	3.28	3.10	4.28	15.09	16.37	14.07	19.85
50th	4.10	4.10	3.60	4.90	20.38	20.57	18.79	23.91
75th	5.60	5.80	4.65	6.30	25.51	26.69	21.97	33.06
80th	6.48	6.48	6.28	6.50	27.92	29.38	23.05	34.25
90th	8.40	8.94	8.39	8.49	33.76	35.63	28.08	45.12
95th	10.00	11.00	10.00	10.05	43.55	48.67	32.60	54.34
98th	15.58	16.58	16.36	11.42	53.79	58.47	37.87	70.62
99th	18.79	19.00	18.59	13.89	66.92	70.15	46.98	74.21
Max	21.00	23.00	19.00	21.00	79.07	118.43	49.69	79.07

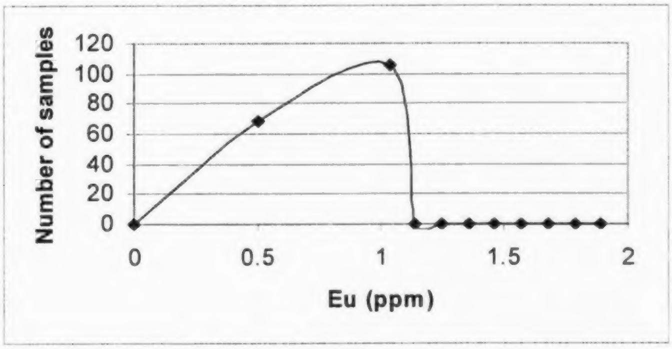
Histograms – Basal Till Population (aT sites excluded)

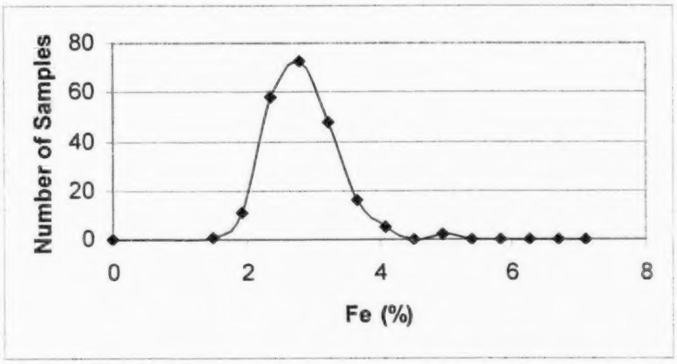




	Eu (ppm)				**Fe (%)**			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	INAA	INAA	INAA	INAA	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	1.06	1.07	1.08	1.03	2.66	2.68	2.51	2.91
Std. Dev.	0.54	0.53	0.54	0.54	0.61	0.66	0.48	0.72
Skewness	0.80	0.80	0.76	0.89	2.84	2.47	1.05	3.69
Kurtosis	-0.62	-0.58	-0.69	-0.43	19.28	13.11	3.72	21.92
Percentiles								
Min	0.50	0.50	0.50	0.50	1.50	1.50	1.50	1.99
25th	0.50	0.50	0.50	0.50	2.29	2.27	2.18	2.45
50th	1.00	1.00	1.00	1.00	2.58	2.59	2.46	2.81
75th	1.00	1.00	1.00	1.00	2.93	2.95	2.77	3.18
80th	2.00	2.00	2.00	1.20	3.09	3.10	2.86	3.27
90th	2.00	2.00	2.00	2.00	3.29	3.33	3.13	3.52
95th	2.00	2.00	2.00	2.00	3.51	3.69	3.22	3.72
98th	2.00	2.00	2.00	2.00	3.81	4.27	3.41	4.23
99th	2.00	2.00	2.00	2.00	4.49	5.13	3.71	5.26
Max	2.00	2.00	2.00	2.00	7.55	7.55	4.94	7.55

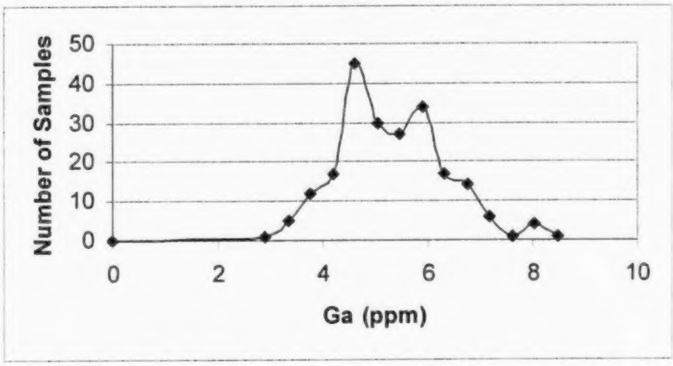
Histograms – Basal Till Population (aT sites excluded)

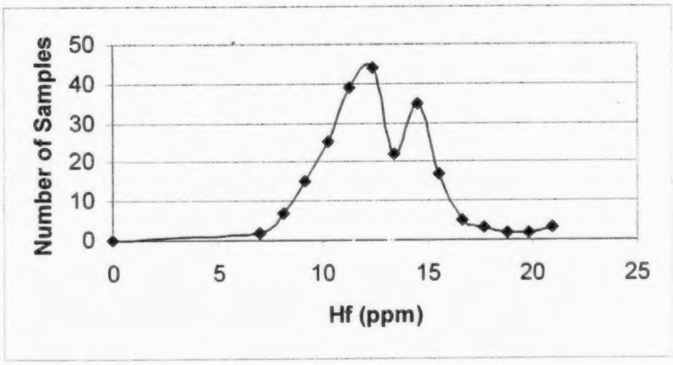




	Ga (ppm)				Hf (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	INAA	INAA	INAA	INAA
n of Values	222	272	142	80	222	272	142	80
Mean	5.12	5.09	4.89	5.53	12.30	12.54	12.87	11.29
Std. Dev.	1.04	1.11	1.08	0.84	2.47	2.72	2.56	1.94
Skewness	0.54	0.44	0.96	0.18	0.78	0.67	0.82	0.07
Kurtosis	0.45	0.48	1.42	-0.39	1.42	0.74	1.30	-0.62
Percentiles								
Min	2.90	2.50	2.90	3.70	7.00	7.00	7.00	7.00
25th	4.35	4.30	4.20	4.90	11.00	11.00	11.00	10.00
50th	5.00	5.00	4.70	5.50	12.00	12.00	12.00	11.00
75th	5.80	5.80	5.60	6.18	14.00	14.00	14.00	12.25
80th	6.00	5.90	5.70	6.36	14.00	14.00	14.80	13.00
90th	6.50	6.40	6.20	6.53	15.00	16.00	16.00	14.00
95th	6.80	6.80	6.80	6.82	16.00	17.45	17.95	14.05
98th	7.77	7.90	7.90	7.08	19.00	20.00	20.00	15.00
99th	7.90	8.13	8.03	7.42	20.00	20.00	20.00	15.00
Max	8.90	8.90	8.90	7.80	22.00	22.00	22.00	15.00

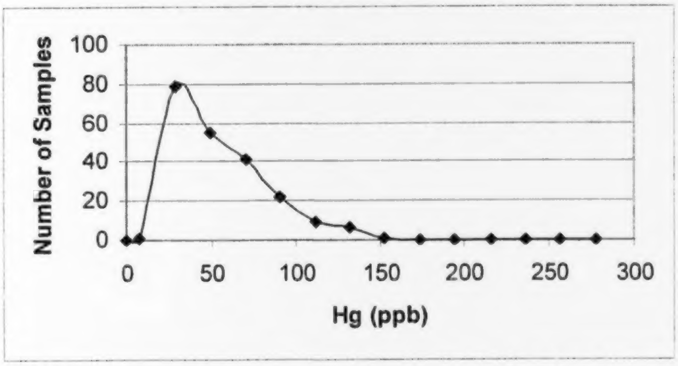
Histograms – Basal Till Population (aT sites excluded)

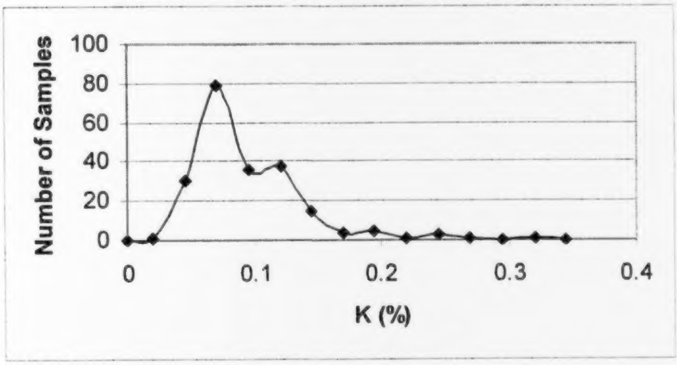




	Hg (ppb)				K (%)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	46.04	52.00	44.88	48.08	0.09	0.08	0.08	0.10
Std. Dev.	32.03	38.52	33.40	29.58	0.05	0.05	0.04	0.06
Skewness	2.81	2.16	3.55	1.02	2.30	2.41	2.10	2.21
Kurtosis	17.16	7.75	23.27	0.99	7.97	8.85	7.42	6.64
Percentiles								
Min	8.00	8.00	8.00	10.00	0.02	0.02	0.02	0.03
25th	23.00	24.00	23.00	22.50	0.05	0.05	0.05	0.06
50th	39.00	45.00	34.00	43.00	0.07	0.07	0.07	0.08
75th	62.50	66.00	59.00	64.00	0.10	0.10	0.10	0.11
80th	66.00	72.80	65.40	65.60	0.11	0.11	0.11	0.12
90th	82.00	95.60	82.00	82.80	0.14	0.13	0.13	0.14
95th	98.60	118.40	93.20	115.30	0.18	0.16	0.15	0.24
98th	118.44	164.68	109.08	119.00	0.24	0.23	0.19	0.24
99th	119.86	189.46	118.92	124.98	0.25	0.24	0.21	0.28
Max	298.00	298.00	298.00	145.00	0.37	0.37	0.32	0.37

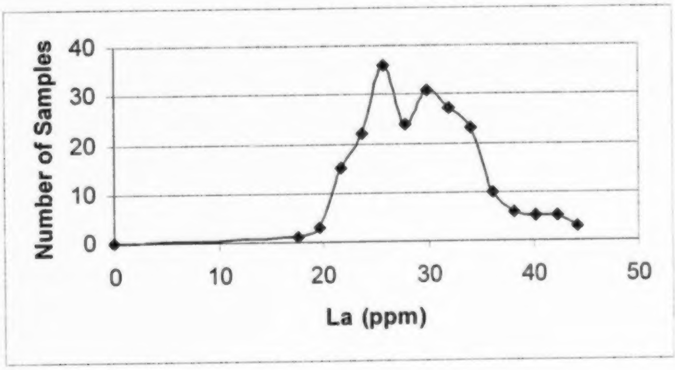
Histograms – Basal Till Population (aT sites excluded)

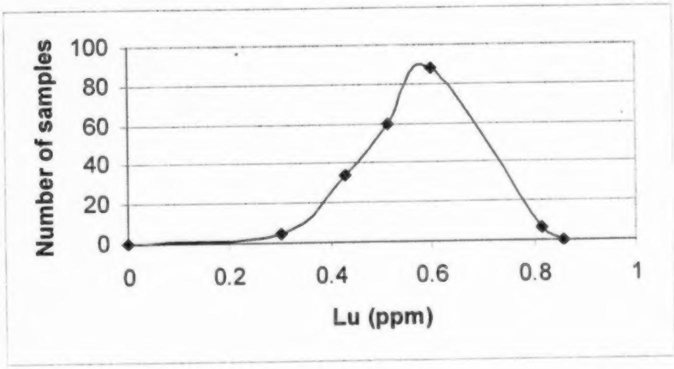




	La (ppm)				Lu (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	INAA	INAA	INAA	INAA
n of Values	222	272	142	80	222	272	142	80
Mean	28.79	28.40	28.52	29.26	0.56	0.56	0.57	0.53
Std. Dev.	5.84	6.18	5.81	5.90	0.11	0.11	0.12	0.10
Skewness	0.74	0.81	0.86	0.56	0.21	0.15	0.26	-0.11
Kurtosis	0.42	0.43	0.64	0.23	0.43	0.17	0.39	0.05
Percentiles								
Min	17.50	16.10	17.50	19.60	0.30	0.30	0.30	0.30
25th	24.35	23.90	24.10	24.80	0.50	0.50	0.50	0.50
50th	28.00	27.40	27.40	29.00	0.60	0.60	0.60	0.50
75th	32.25	31.90	31.40	32.85	0.60	0.60	0.60	0.60
80th	33.10	32.90	32.86	33.64	0.60	0.60	0.60	0.60
90th	36.22	37.12	36.06	36.46	0.70	0.70	0.70	0.61
95th	40.50	41.61	40.50	39.45	0.70	0.75	0.79	0.70
98th	43.69	44.21	43.10	43.58	0.80	0.80	0.82	0.70
99th	45.26	45.74	45.04	44.35	0.88	0.83	0.90	0.72
Max	46.30	46.30	46.30	46.20	0.90	0.90	0.90	0.80

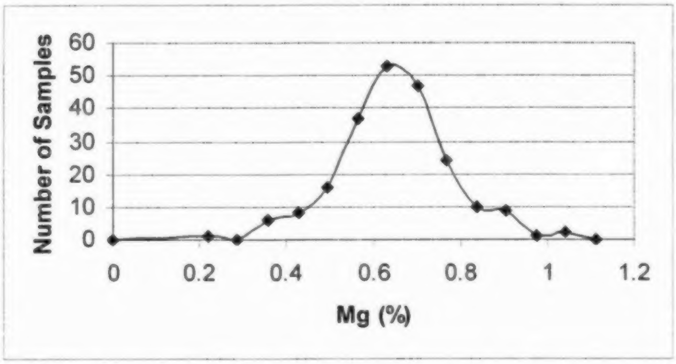
Histograms – Basal Till Population (aT sites excluded)

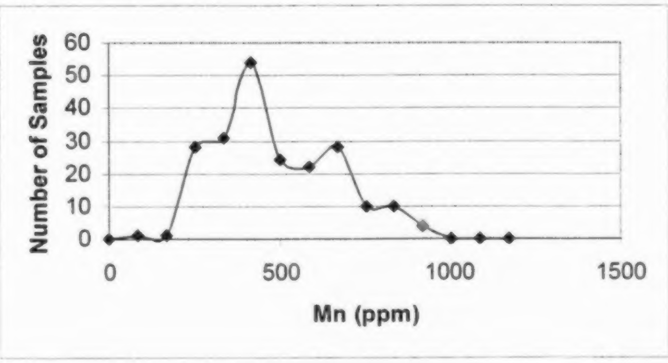




	Mg (%)				Mn (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	0.62	0.60	0.61	0.63	454.08	449.72	443.74	472.26
Std. Dev.	0.13	0.14	0.14	0.12	190.99	197.30	188.08	195.88
Skewness	0.40	0.35	0.52	0.17	0.95	1.14	0.72	1.33
Kurtosis	1.68	1.08	2.06	0.76	1.46	1.94	0.89	2.27
Percentiles								
Min	0.22	0.22	0.22	0.32	86.00	86.00	86.00	195.00
25th	0.54	0.52	0.54	0.55	316.00	311.50	298.00	342.75
50th	0.61	0.60	0.61	0.62	402.00	399.00	402.00	404.00
75th	0.70	0.69	0.69	0.70	581.50	576.00	587.00	575.25
80th	0.71	0.70	0.71	0.72	623.80	619.00	619.00	634.20
90th	0.77	0.76	0.76	0.77	699.20	696.80	679.80	749.20
95th	0.85	0.82	0.85	0.82	805.00	805.00	761.60	849.20
98th	0.90	0.89	0.91	0.88	853.76	876.00	805.56	883.84
99th	0.99	0.95	0.99	0.92	905.44	1132.58	822.36	991.43
Max	1.18	1.18	1.18	1.00	1254.00	1260.00	1223.00	1254.00

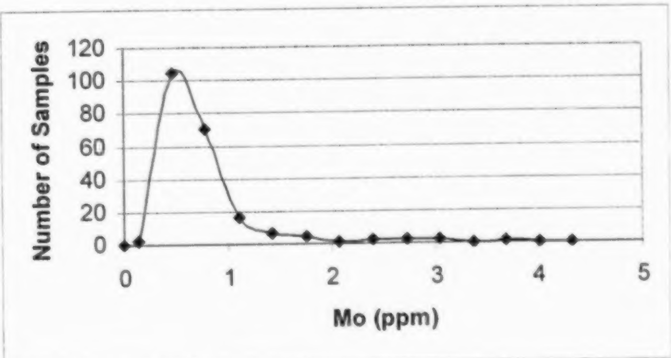
Histograms – Basal Till Population (aT sites excluded)

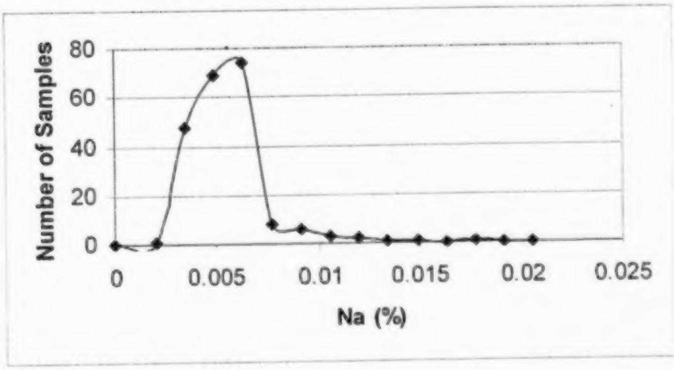




	Mo (ppm)				Na (%)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	0.62	0.69	0.45	0.92	0.00	0.00	0.00	0.01
Std. Dev.	0.55	0.67	0.33	0.72	0.00	0.00	0.00	0.00
Skewness	3.85	3.35	6.60	2.75	3.54	3.69	4.47	1.91
Kurtosis	19.22	12.68	58.73	9.65	19.27	21.57	28.02	4.31
Percentiles								
Min	0.14	0.14	0.14	0.28	0.00	0.00	0.00	0.00
25th	0.36	0.36	0.32	0.51	0.00	0.00	0.00	0.00
50th	0.47	0.48	0.39	0.69	0.00	0.00	0.00	0.01
75th	0.68	0.70	0.51	0.99	0.01	0.01	0.01	0.01
80th	0.75	0.78	0.53	1.13	0.01	0.01	0.01	0.01
90th	1.03	1.22	0.66	1.62	0.01	0.01	0.01	0.01
95th	1.48	2.16	0.76	2.48	0.01	0.01	0.01	0.01
98th	2.53	3.32	1.10	2.77	0.01	0.01	0.01	0.01
99th	2.79	3.89	1.35	3.23	0.01	0.01	0.01	0.01
Max	4.65	4.65	3.57	4.65	0.02	0.02	0.02	0.01

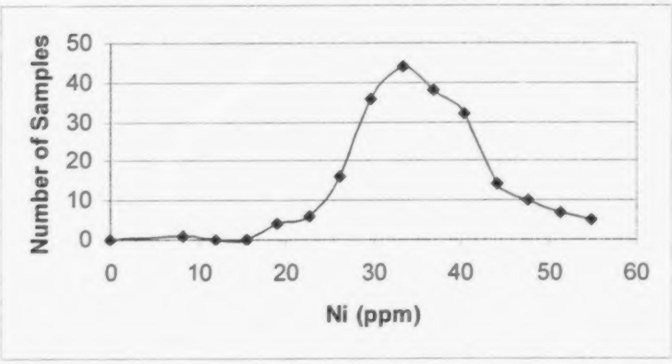
Histograms – Basal Till Population (aT sites excluded)

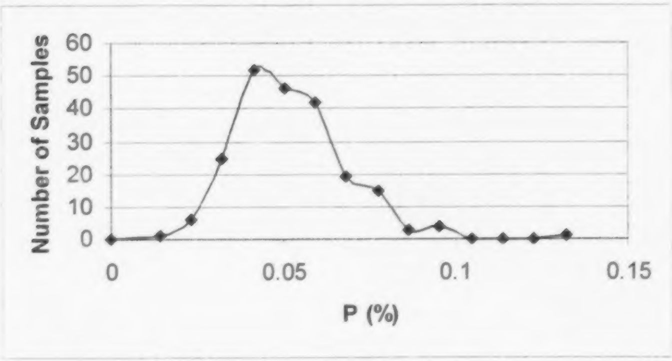




	Ni (ppm)				P (%)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	34.21	33.97	33.51	35.43	0.05	0.05	0.05	0.05
Std. Dev.	7.79	8.12	7.79	7.67	0.02	0.02	0.02	0.02
Skewness	0.36	0.45	0.54	0.09	1.46	1.72	0.98	2.35
Kurtosis	0.66	0.57	1.35	-0.16	5.34	5.51	2.83	10.53
Percentiles								
Min	8.30	8.30	8.30	16.60	0.01	0.01	0.01	0.02
25th	29.05	28.30	28.30	29.48	0.04	0.04	0.04	0.04
50th	33.40	33.10	32.70	34.55	0.05	0.05	0.05	0.05
75th	38.05	38.10	37.40	40.78	0.06	0.06	0.06	0.06
80th	39.80	39.78	38.08	42.46	0.06	0.06	0.06	0.06
90th	44.50	44.54	42.84	44.66	0.07	0.07	0.07	0.07
95th	48.66	48.74	48.48	48.78	0.08	0.08	0.08	0.07
98th	52.42	53.25	53.66	51.24	0.09	0.10	0.09	0.08
99th	53.77	56.24	55.53	51.58	0.09	0.14	0.09	0.10
Max	58.40	60.10	58.40	52.20	0.14	0.14	0.13	0.14

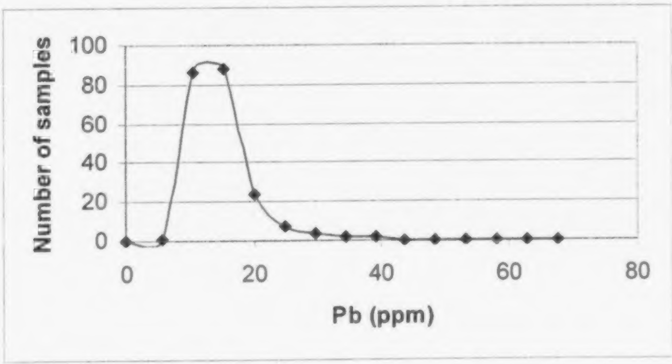
Histograms – Basal Till Population (aT sites excluded)

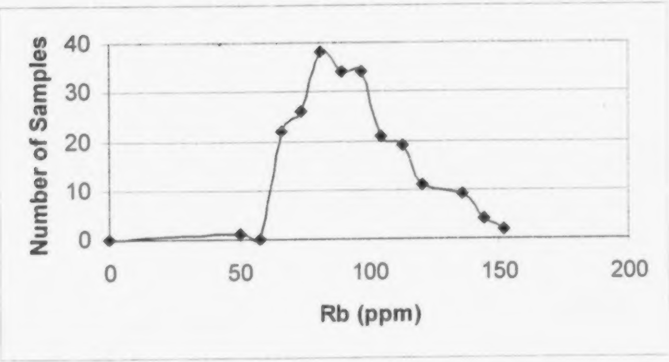




	Pb (ppm)				Rb (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	INAA	INAA	INAA	INAA
n of Values	222	272	142	80	222	272	142	80
Mean	12.77	13.68	11.77	14.52	89.82	88.63	85.32	97.81
Std. Dev.	6.42	8.14	4.72	8.39	20.54	22.25	19.74	19.58
Skewness	4.61	4.84	2.44	4.62	0.79	1.12	0.93	0.85
Kurtosis	35.45	35.19	8.08	29.43	0.46	2.22	0.59	0.81
Percentiles								
Min	5.71	5.71	6.17	5.71	50.00	46.00	50.00	62.00
25th	9.38	9.59	9.00	10.51	75.00	73.00	72.25	86.00
50th	11.30	11.68	10.62	13.02	87.00	86.00	81.50	94.00
75th	14.29	15.19	13.13	15.49	100.00	100.00	95.75	110.00
80th	15.17	16.43	13.84	16.74	110.00	100.00	99.80	110.00
90th	18.43	19.91	16.77	19.94	120.00	120.00	110.00	130.00
95th	23.02	26.70	20.11	25.90	130.00	130.00	120.00	130.50
98th	29.55	34.70	28.81	30.75	140.00	145.80	131.80	144.20
99th	34.39	38.58	30.56	43.56	147.90	150.00	140.00	152.10
Max	72.35	87.55	36.05	72.35	160.00	200.00	150.00	160.00

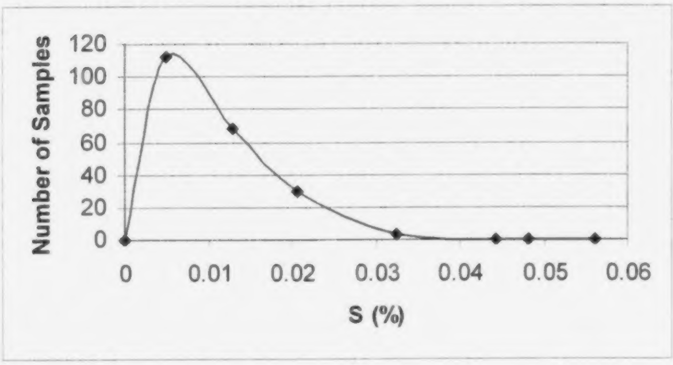
Histograms – Basal Till Population (aT sites excluded)

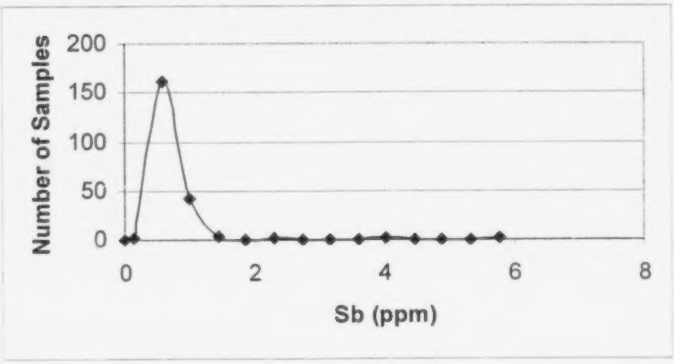




	S (%)				Sb (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	0.01	0.01	0.01	0.01	0.55	0.60	0.55	0.55
Std. Dev.	0.01	0.01	0.01	0.01	0.64	0.81	0.73	0.47
Skewness	3.47	3.35	3.96	2.91	6.48	6.53	6.33	5.32
Kurtosis	18.38	15.00	24.92	12.87	47.25	50.67	42.82	34.92
Percentiles								
Min	0.01	0.01	0.01	0.01	0.14	0.14	0.14	0.18
25th	0.01	0.01	0.01	0.01	0.33	0.34	0.31	0.35
50th	0.01	0.01	0.01	0.01	0.43	0.44	0.40	0.44
75th	0.01	0.01	0.01	0.01	0.57	0.57	0.52	0.61
80th	0.01	0.02	0.01	0.02	0.61	0.62	0.59	0.67
90th	0.02	0.02	0.02	0.02	0.75	0.77	0.74	0.77
95th	0.02	0.03	0.02	0.02	0.92	1.12	0.91	0.89
98th	0.03	0.04	0.02	0.03	1.86	3.43	1.88	1.58
99th	0.03	0.06	0.03	0.04	3.86	4.37	4.79	2.55
Max	0.06	0.08	0.06	0.06	6.20	8.62	6.20	3.87

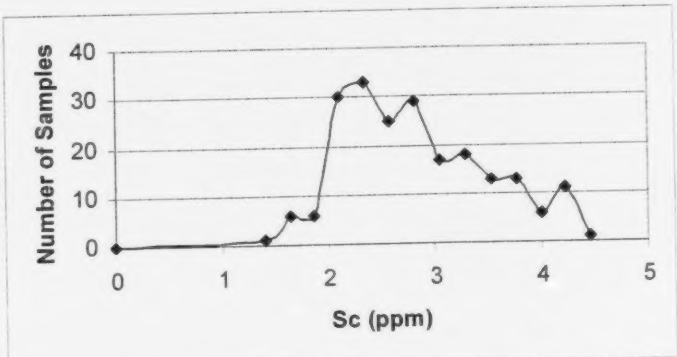
Histograms – Basal Till Population (aT sites excluded)

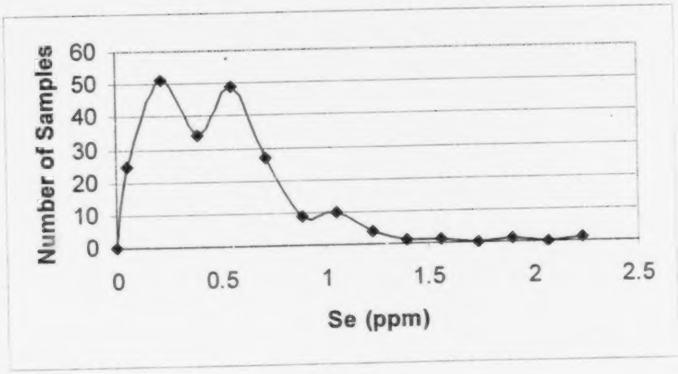




	Sc (ppm)				Se (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	2.76	2.74	2.75	2.79	0.43	0.48	0.36	0.54
Std. Dev.	0.72	0.71	0.72	0.74	0.37	0.42	0.29	0.46
Skewness	0.58	0.58	0.49	0.73	2.29	2.04	2.60	1.72
Kurtosis	-0.30	-0.25	-0.49	0.02	8.15	5.41	14.06	4.01
Percentiles								
Min	1.40	1.40	1.40	1.60	0.05	0.05	0.05	0.05
25th	2.20	2.20	2.20	2.23	0.20	0.20	0.20	0.20
50th	2.70	2.60	2.70	2.65	0.30	0.40	0.30	0.50
75th	3.20	3.20	3.20	3.20	0.60	0.60	0.50	0.70
80th	3.32	3.30	3.38	3.30	0.60	0.70	0.50	0.80
90th	3.80	3.74	3.80	3.86	0.80	0.94	0.70	1.10
95th	4.13	4.07	4.02	4.33	1.00	1.20	0.80	1.32
98th	4.50	4.44	4.20	4.50	1.37	1.97	0.93	1.94
99th	4.50	4.50	4.39	4.52	2.06	2.20	1.00	2.17
Max	4.70	4.70	4.70	4.60	2.40	2.40	2.30	2.40

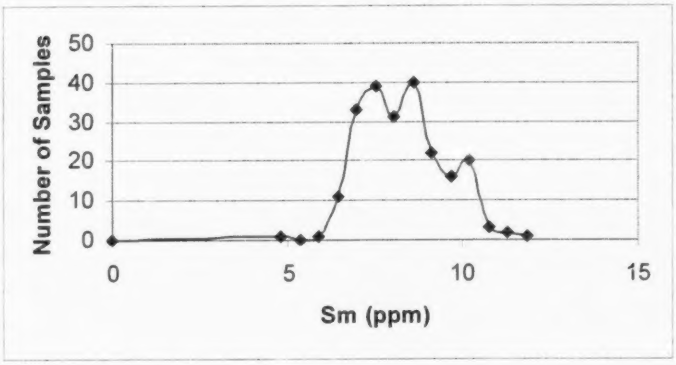
Histograms – Basal Till Population (aT sites excluded)

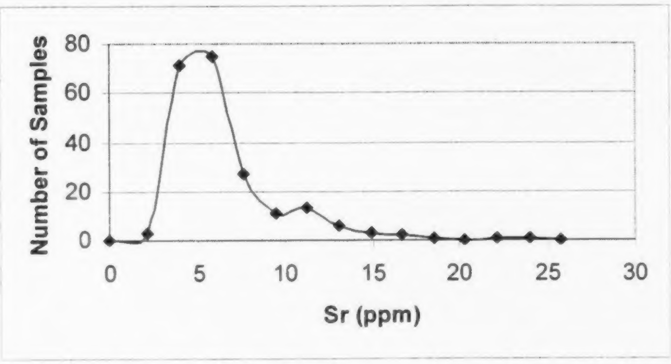




	Sm (ppm)				Sr (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	INAA	INAA	INAA	INAA	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	8.06	8.07	8.29	7.65	5.83	5.64	6.06	5.43
Std. Dev.	1.25	1.33	1.24	1.18	3.56	3.51	3.65	3.37
Skewness	0.54	0.60	0.58	0.52	2.81	2.78	2.71	3.12
Kurtosis	0.26	0.47	0.35	0.01	10.84	10.37	10.67	12.28
Percentiles								
Min	4.80	4.80	5.40	4.80	2.20	2.10	2.20	2.20
25th	7.10	7.10	7.33	6.80	3.80	3.60	3.80	3.65
50th	7.95	7.95	8.15	7.45	4.70	4.50	4.80	4.60
75th	8.80	8.80	9.08	8.40	6.50	6.30	7.00	5.55
80th	9.10	9.20	9.30	8.50	7.02	6.78	7.88	6.22
90th	10.00	10.00	10.00	9.21	9.86	9.74	9.98	9.53
95th	10.00	10.20	10.20	10.00	12.63	12.84	12.74	11.35
98th	10.87	11.00	11.09	10.08	16.22	16.18	15.14	15.96
99th	11.40	11.83	11.74	10.31	21.15	20.18	20.30	18.16
Max	12.40	12.90	12.40	10.70	27.60	27.60	27.60	23.70

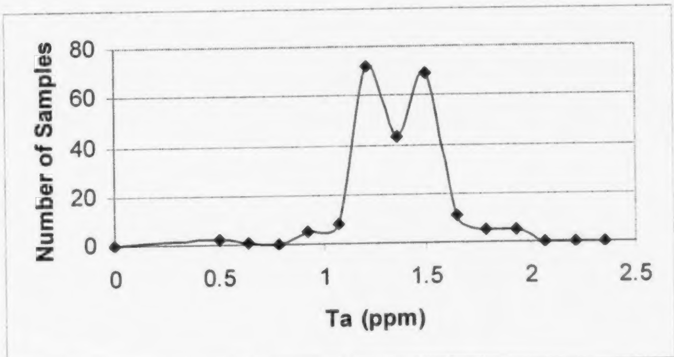
Histograms – Basal Till Population (aT sites excluded)

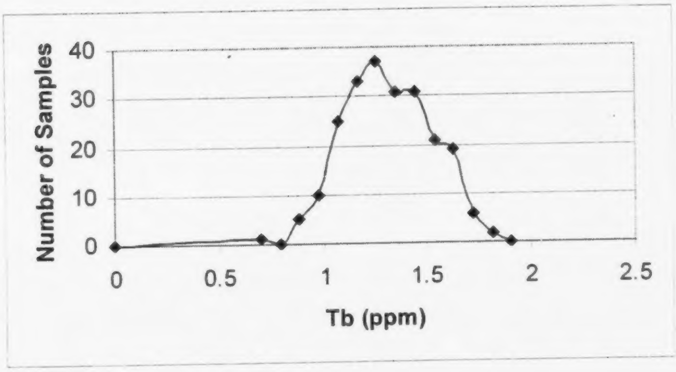




	Ta (ppm)				Tb (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA
n of Values	222	272	142	80	222	272	142	80
Mean	1.31	1.30	1.31	1.32	1.26	1.27	1.29	1.22
Std. Dev.	0.22	0.27	0.18	0.29	0.23	0.24	0.22	0.23
Skewness	0.23	-0.35	0.24	0.15	0.18	0.33	0.15	0.29
Kurtosis	4.50	11.02	0.31	3.73	-0.30	-0.12	-0.24	-0.26
Percentiles								
Min	0.50	-0.50	0.80	0.50	0.70	0.70	0.80	0.70
25th	1.20	1.20	1.20	1.20	1.10	1.10	1.10	1.00
50th	1.30	1.30	1.30	1.30	1.25	1.20	1.30	1.20
75th	1.40	1.40	1.40	1.50	1.40	1.40	1.50	1.40
80th	1.50	1.50	1.48	1.50	1.50	1.50	1.50	1.40
90th	1.50	1.60	1.50	1.60	1.60	1.60	1.60	1.50
95th	1.60	1.70	1.60	1.71	1.60	1.70	1.60	1.61
98th	1.80	1.80	1.70	1.80	1.70	1.80	1.70	1.70
99th	1.80	1.90	1.76	1.95	1.78	1.83	1.76	1.72
Max	2.50	2.80	1.80	2.50	2.00	2.00	2.00	1.80

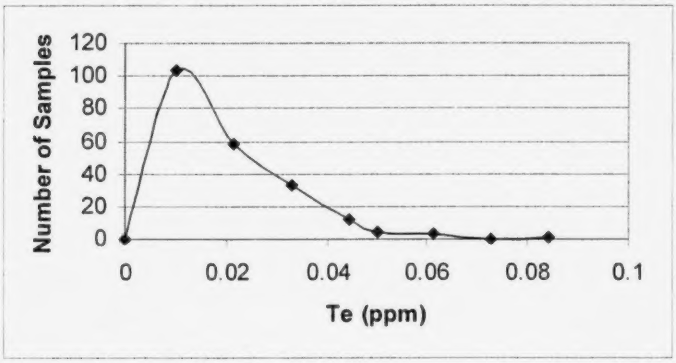
Histograms – Basal Till Population (aT sites excluded)

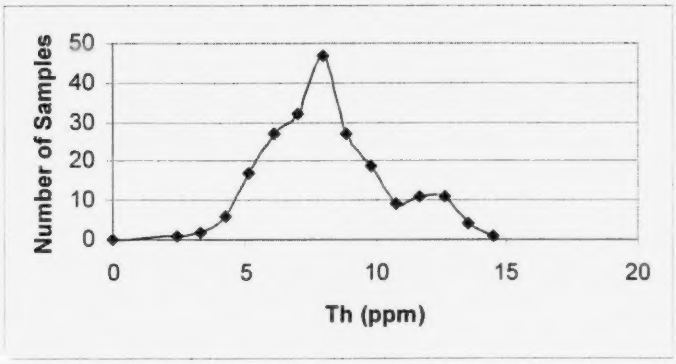




	Te (ppm)				Th (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	0.02	0.02	0.02	0.03	7.74	7.79	7.44	8.25
Std. Dev.	0.01	0.01	0.01	0.02	2.35	2.51	2.24	2.47
Skewness	2.07	1.87	1.20	1.55	0.51	0.98	0.53	0.41
Kurtosis	6.28	4.53	0.67	2.95	0.14	1.98	0.05	0.26
Percentiles								
Min	0.01	0.01	0.01	0.01	2.40	2.40	2.60	2.40
25th	0.01	0.01	0.01	0.01	6.20	6.10	6.00	6.80
50th	0.02	0.02	0.01	0.02	7.40	7.40	7.20	7.95
75th	0.03	0.03	0.02	0.03	9.00	9.00	8.60	9.60
80th	0.03	0.03	0.02	0.03	9.60	9.58	9.00	9.86
90th	0.03	0.04	0.03	0.05	11.16	11.30	10.84	12.00
95th	0.04	0.05	0.03	0.06	12.40	12.50	11.74	12.52
98th	0.06	0.06	0.04	0.07	12.94	13.60	12.66	13.38
99th	0.06	0.07	0.04	0.08	13.19	14.97	12.93	14.09
Max	0.09	0.09	0.04	0.09	15.40	20.00	13.20	15.40

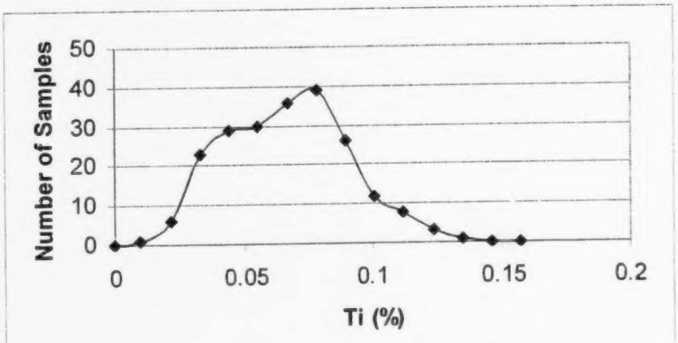
Histograms – Basal Till Population (aT sites excluded)

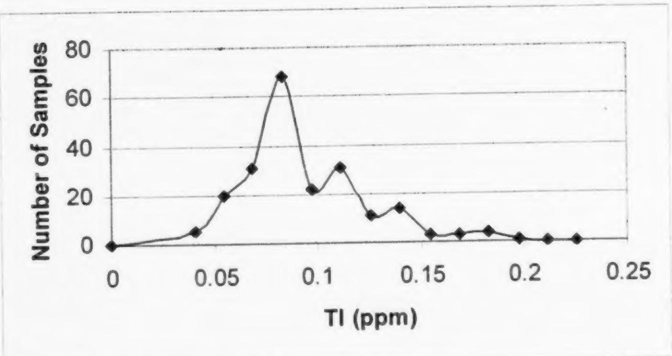




	Ti (%)				Tl (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	0.06	0.06	0.06	0.06	0.09	0.09	0.08	0.10
Std. Dev.	0.03	0.02	0.03	0.02	0.03	0.03	0.03	0.04
Skewness	0.49	0.50	0.74	-0.04	1.46	1.24	1.69	1.25
Kurtosis	0.75	0.75	1.25	-0.23	3.05	2.26	5.33	1.73
Percentiles								
Min	0.01	0.01	0.01	0.02	0.04	0.03	0.04	0.05
25th	0.04	0.04	0.04	0.05	0.06	0.06	0.06	0.08
50th	0.06	0.06	0.06	0.07	0.08	0.08	0.07	0.10
75th	0.08	0.08	0.08	0.08	0.10	0.10	0.09	0.12
80th	0.08	0.08	0.08	0.08	0.11	0.11	0.10	0.13
90th	0.09	0.09	0.09	0.09	0.13	0.13	0.12	0.16
95th	0.10	0.10	0.10	0.10	0.15	0.15	0.13	0.17
98th	0.11	0.11	0.11	0.11	0.18	0.17	0.14	0.18
99th	0.12	0.12	0.13	0.11	0.19	0.18	0.15	0.20
Max	0.17	0.17	0.17	0.12	0.24	0.24	0.23	0.24

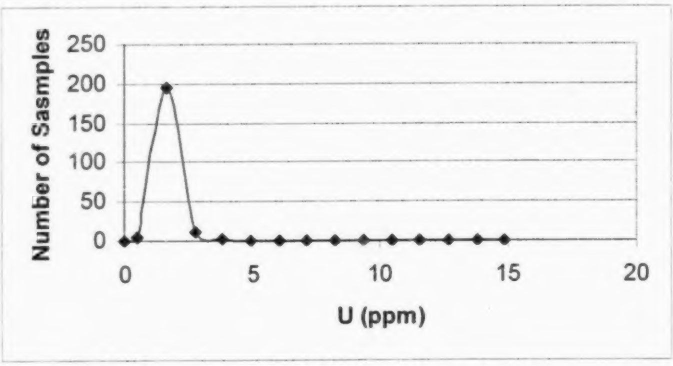
Histograms – Basal Till Population (aT sites excluded)

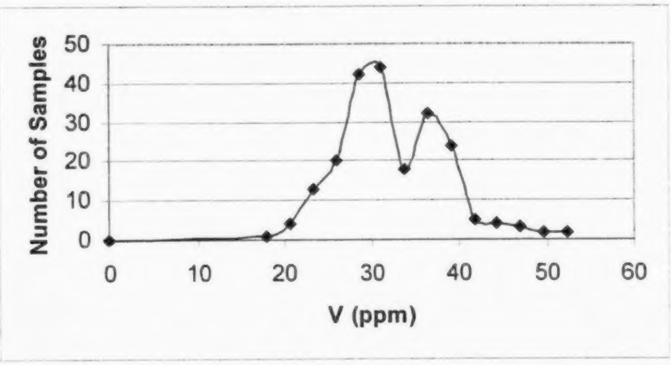




	U (ppm)				V (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80	222	272	142	80
Mean	1.14	1.14	1.11	1.20	31.21	31.05	29.28	34.59
Std. Dev.	1.14	1.04	1.38	0.50	6.37	6.57	5.94	5.70
Skewness	10.69	11.34	9.58	1.83	0.76	0.82	1.19	0.63
Kurtosis	135.95	157.85	101.79	4.36	0.97	1.35	2.86	0.47
Percentiles								
Min	0.50	0.50	0.50	0.60	18.00	17.00	18.00	23.00
25th	0.80	0.80	0.70	0.90	27.00	27.00	25.00	30.00
50th	0.90	1.00	0.90	1.05	30.00	30.00	28.00	35.00
75th	1.20	1.20	1.10	1.38	35.00	35.00	33.00	38.00
80th	1.30	1.30	1.20	1.50	36.00	36.00	34.00	39.00
90th	1.60	1.60	1.40	1.93	39.00	39.00	36.40	40.30
95th	2.00	2.00	1.60	2.02	42.30	42.00	39.20	46.00
98th	2.99	2.57	2.95	2.56	48.16	49.00	43.56	49.00
99th	3,54	3.34	4.43	3.12	50.72	51.00	48.84	49.46
Max	16.00	16.00	16.00	3.20	55.00	56.00	55.00	51.00

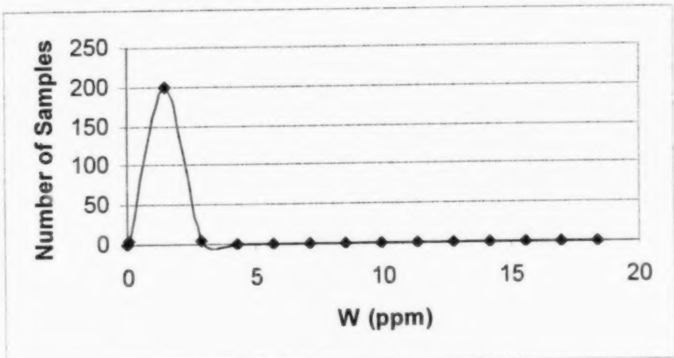
Histograms – Basal Till Population (aT sites excluded)

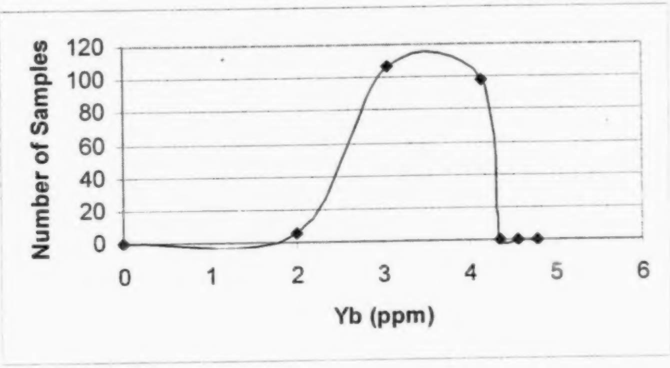




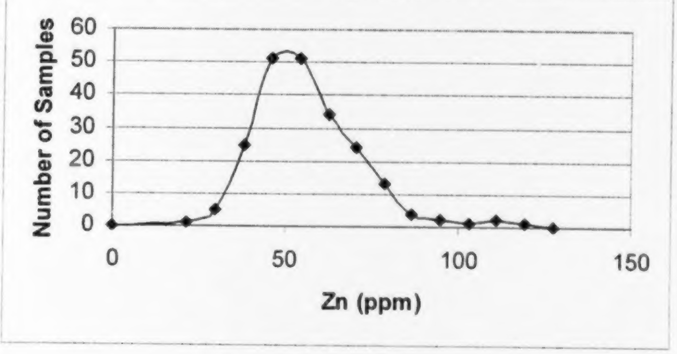
	W (ppm)				Yb (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS	INAA	INAA	INAA	INAA
n of Values	222	272	142	80	222	272	142	80
Mean	0.77	0.72	0.59	1.09	3.53	3.55	3.58	3.44
Std. Dev.	2.52	2.28	1.98	3.25	0.64	0.66	0.66	0.59
Skewness	6.22	6.78	6.80	5.26	0.27	0.24	0.40	-0.13
Kurtosis	39.64	48.07	47.81	27.57	-0.29	0.20	-0.39	-0.47
Percentiles								
Min	0.05	0.05	0.05	0.10	2.00	2.00	2.00	2.00
25th	0.20	0.20	0.10	0.30	3.00	3.00	3.00	3.00
50th	0.20	0.30	0.20	0.35	3.00	4.00	4.00	3.00
75th	0.40	0.40	0.30	0.50	4.00	4.00	4.00	4.00
80th	0.50	0.50	0.30	0.66	4.00	4.00	4.00	4.00
90th	1.00	1.00	0.78	1.10	4.00	4.00	4.00	4.00
95th	1.40	1.40	1.30	1.55	4.95	5.00	5.00	4.00
98th	10.00	7.48	4.09	14.59	5.00	5.00	5.00	4.00
99th	15.90	15.18	12.54	19.49	5.00	5.00	5.00	4.21
Max	19.80	19.80	16.10	19.80	5.00	6.00	5.00	5.00

Histograms – Basal Till Population (aT sites excluded)





	Zn (ppm)			
	aT Sites Excluded	aT Sites Included	F'ton Cover Sequence	St. Croix Terrane
Analytical Method	ICP-MS	ICP-MS	ICP-MS	ICP-MS
n of Values	222	272	142	80
Mean	52.58	53.59	48.13	60.40
Std. Dev.	16.03	19.05	13.42	17.29
Skewness	1.50	2.86	1.26	1.70
Kurtosis	4.40	17.20	3.25	4.83
Percentiles				
Min	21.50	21.50	21.50	36.00
25th	41.30	41.20	38.80	49.50
50th	50.70	50.50	45.80	56.90
75th	60.80	61.25	55.40	67.08
80th	63.72	65.18	56.72	71.00
90th	71.46	73.36	64.24	77.71
95th	78.35	84.15	71.30	88.16
98th	93.11	105.12	81.28	111.66
99th	109.50	113.61	91.08	119.12
Max	135.60	208.30	109.50	135.60

Histograms – Basal Till Population (aT sites excluded)